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A New Program and
Free Training Plan
on page 144

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RADIO GUIDED BOMBERS
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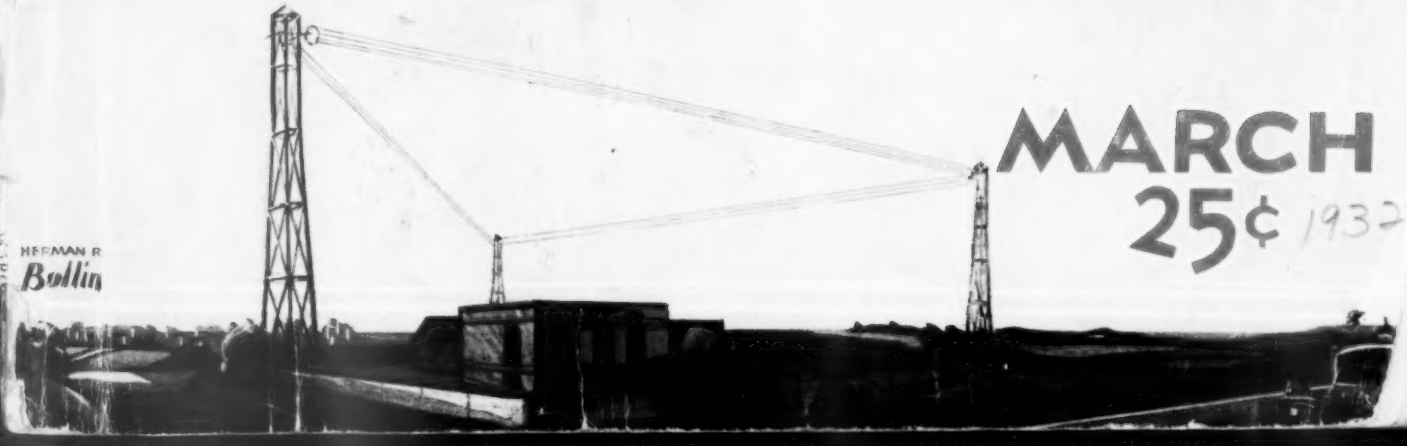

HERMAN R. Bollin

MARCH
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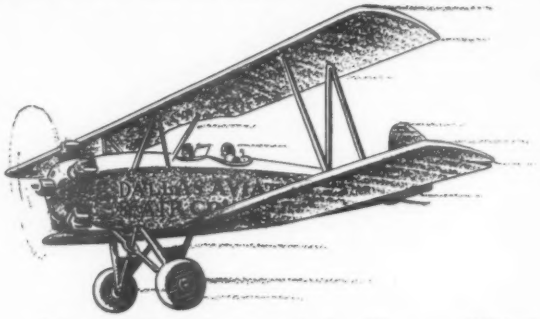

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An Airy Chat With the Editor

THERE are so many things to take up in this issue, and items of real importance at that, that it is rather difficult to figure out just how to start the ball rolling. But, before we start in with the letters and things that have been received during the past month, we wish to thank our correspondents for their unusual diligence in writing us interesting letters.

This has been a banner month for letter writing. Our mail has practically doubled in the last thirty days. And almost every letter had something in it that made us stop and think a bit. It was really remarkable how many subjects of real merit were brought up and disposed of—at least in our correspondents' mind.

Putting the old adding machine on the job, the Airy Chat department has rolled up a total of exactly 243 letters that really merit reprinting in these columns. And we are not counting requests for addresses nor the letters that belong to the Question and Answer editor. Think of it!

* * *

BY ALL rights, we should start our first comments on the subject of the cover—but we are going to waive all precedent aside and start way down in the middle of the book. Here you will find a simple and yet comprehensive article on the subject of airplane instruments that has been in request for a long time. If you don't know what a tachometer or an artificial horizon are—here's your chance.

* * *

AND right here, I want to introduce you to Mr. Hawley, our new assistant Airy Chatterer, who is doing bookoo work on the book. Besides doing a whole lot of other useful things, it will be Mr. Hawley's great pleasure to keep the Round Robin going on its rounds—something that will be greeted by wild cheers from all concerned. Mr. Hawley is a graduate engineer, so don't be afraid to put over the hard ones. He'll answer 'em. Glad to know you, Mr. Hawley.

* * *

THE Airy Chat has threatened to do a number of things in the past, and now it has got around to the fulfillment of another promise. This particular promise, is an abbreviated list of War-Plane Photo Phans whom we are pleased to introduce to each other. This, I hope, will lead to an interchange of ideas and photos between and among the patrons of this corner.

* * *

JUST a passing comment, on the way, to remark that the lightplane and glider builders are certainly kicking in with letters to "What Our Readers Are Building." Merciful heavens, I never knew before how many ways there are of dolling up a Model "T" engine so that it will fly! They set this good old "T" in all sorts of positions, right-side-up and up-side-down, and all of the builders "are more than satisfied with the results." Fine, I sincerely hope that we will get a whole lot of letters along this line—for we're proud of our home-mechanics.

* * *

WE'VE had a lot of letters on the subject of our War Plane Album feature, "A Flock of Fokkers." About twenty of our war plane fans think that one of the ships is an Albatross, just because it has a faired fuselage and interplane struts resembling those of the Albatross. No, you're wrong, and I can prove it. How? Why, for the reason that these photos were sent to us by the Fokker factory in Amsterdam, Holland.

* * *

OUR Government training idea, for building up a civilian air corps reserve, has been mighty popular. We have received bunches of letters commending the step, and many have signed their names and their friends' names on improvised petitions. One man was so enthused that he sent in a letter signed by thirty of his friends. That's the spirit.

We have taken one letter out of a great pile, as being representative of the attitude displayed by our readers. This really fine letter is from Joseph R. Keller, Neal, Kas.

I wish to register a good sound kick. I secured a January POPULAR AVIATION *and on page* 15 *I read your article, "Seeks Government Aid in Training."*

I see that you have made the age limits 14 *to* 25. *Now this is my grand howl. I am a rural Letter Carrier, am* 42 *years of age and I have two sons ages* 10 *and* 12—*all three of us want flying lessons.*

Why not make the age limits 18 *to* 50? *I know that I could learn to be a reserve pilot for the U. S., but I have never had the money to take up flying. I think that the next war will be in the air. I hope it never comes, but when it does, young men of* 18 *and young old-men of* 45 *or* 50, *can fly pursuit ships in the same formation and do ground work shoulder to shoulder.*

When your paper comes out, I am going to circulate the petition but I do wish that you would change the age limits.

Another thing that I wish you would do for me. My sons and I are model builders, and we have longed for a power plant that would carry a model on a long flight. On page 48 *you gave part of the drawing and explanation of the Steam Propelled Power Plant for Models.*

You did not make the drawing of the water pump clear; can you supply me with more information?

* * *

And here is another remarkable fact. We have had a great response from letter carriers. Are they particularly air-minded as a class? The questions concerning the water pump, Mr. Keller, will be answered in another issue, for this pump is a tricky little device to make.

* * *

YOU are now going to read the last entry in the Schneider cup controversy, and from now on we will have to content ourselves with the facts in the case. This letter is from William Jackson, 2439 Pots St., San Francisco, Cal., who offers the following opinion:

Put me down as another crank who would like to send his opinion in concerning the article from the Italian Monthly. Let the Italians think what they want to about England winning the Schneider cup. And why does Italy take the attitude that she does? England won it fairly, so why the complaint?

Just because the French and Italian entries were not ready, why should England wait? The two losers had the same amount of time that England had. Is it because England set about in a systematic way to be ready at a certain time and were ready to race?

(*Continued on page* 197)

XUM

POPULAR AVIATION

A Magazine for the Promotion of Amateur Aviation and Private Flying

Volume X MARCH, 1932 Number 3

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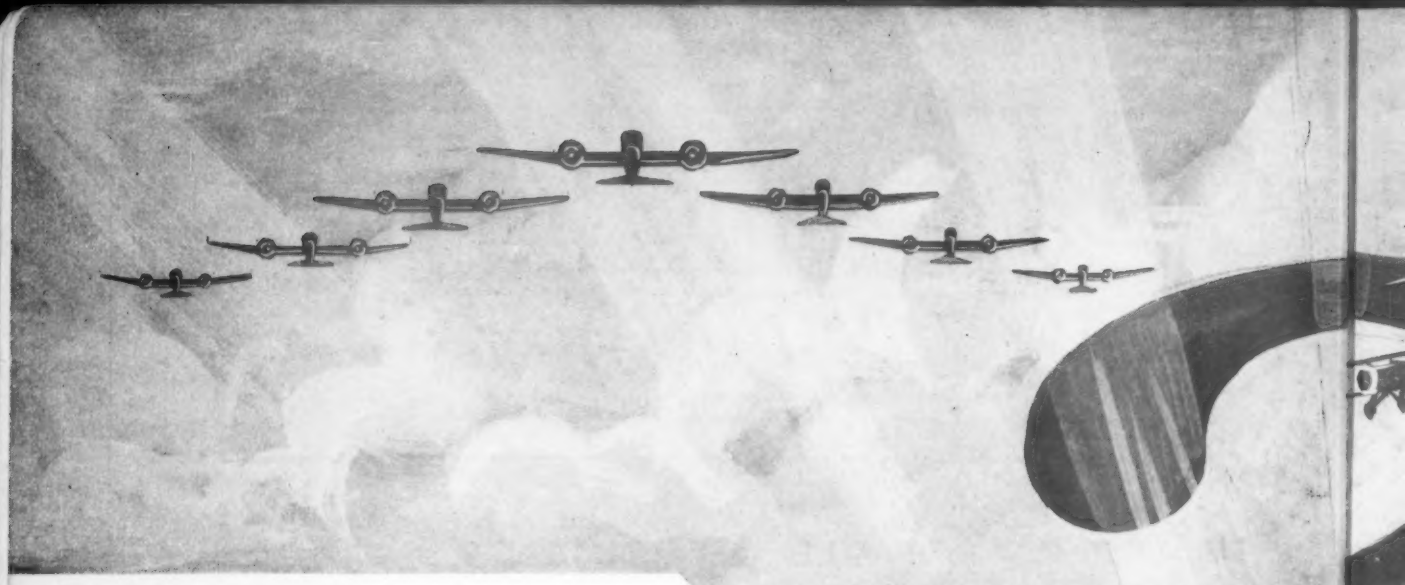


The Preparedness Fiasco

by John B. Rathbun

A concrete example of the spirit of war and hate now hovering over Europe. The above photograph is a reproduction of a German book received in the offices of Popular Aviation. Translated, it reads "War in the Air 1936—The Destruction of Paris."

THE World is a smoldering ember of hatred. No Pacifist can deny it. Unrest in Europe—war in China—revolt in Asia. And at any moment some trivial incident may embroil all of the nations in a bitter war. The World is bankrupt and demands readjustment—another potential reason for a world-wide conflict.

Then we have the United States, at once the most hated and envied of all the nations—and yet the least feared. Unprepared, as usual, this country is a standing invitation for trouble. Again, we have what the other nations desire most — money and natural resources of almost unbelievable magnitude. A remarkable combination of factors that may precipitate us into war at almost any time with our debtor nations.

There is hardly a nation in the World that would not profit by the defeat of the United States. And yet we stand, bound and helpless, in a state of unpreparedness unparalleled at any period in our history—even in 1917. And particularly is this state of unpreparedness true in respect to our aerial arm of defense.

Under the best of conditions, the topography of the United States places it at a disadvantage. There are thousands of miles of coast-line to defend, with our largest cities located within gun-fire of an enemy navy. There are still other thousands of miles of undefended frontier that might or might not prove a menace.

True, we are located at a long distance from any nation likely to enter into a war with us, but in these days of airplanes and high-speed cruisers, an invasion is only a matter of a few days—or hours. And, if invaded, just where and how would we raise the necessary trained personnel to repel the attack within the time limit demanded?

A trained personnel suited for modern combat is not built up in a week. Neither is the necessary equipment designed, developed and manufactured in a week. Even with all of our tremendous engineering and manufacturing resources available, it would require nearly a year to get them under efficient production, just as it did in 1917-1918.

And, in 1917 we had an advantage that we do not have at the present time. That is, we had been working for some time on war material for the Allies before we entered the war ourselves, and were trained in the manufacture of munitions by this pre-war experience.

XUM

ich

Which would you prefer? A few expensive superplanes or a tremendous fleet of small machines with a sufficiency of pilots?

The Editor of POPULAR AVIATION Gives His Choice

At that time we had a fairly well trained technical personnel, capable of developing and producing munitions, but where is that personnel today? Do you believe that a sufficient corps of engineers and chemists could be organized and put into service in a week? You may believe this, I don't.

Looking back to the years 1917 and 1918, I remember the tremendous rush, confusion and loss resulting from unpreparedness. Our army was poorly trained, it suffered from the lack of adequate equipment, and as subsequent events proved, this condition spelled death for thousands of our men who otherwise would have lived. And our condition is even worse today because the present generation lacks the immediate experience of the army of 1917.

In 1917, many engines and ships were put into production only to be consigned to the junk-pile immediately after they were completed. There had been no prolonged period of experimental development and they were built upon theory or "paper" ideas that often proved worthless under the actual test of battle. More money and more men sacrificed uselessly to the God of unpreparedness.

Wagon makers built airplanes and airplane builders produced wagons. Every industry was seemingly put to work upon the jobs for which they were least adapted. Technical men dug trenches and waded through the mud of France while untrained men were wasted in the technical branches. A crying shame and waste of the personnel.

And yet we sit complacently and smugly, lulled into a false sense of security by the siren song of men and nations to whose best interest it is to have us unprepared. There is malicious and misleading propaganda today just as in the war time, and it is the false propaganda singing "peace and security" that will prove ultimately the most dangerous of all propaganda.

Consoling assurances of our mighty strength and limitless resources have closed our eyes to the actual danger that we are now facing. Strength we have, but it is only potential strength —not immediately dynamic nor available.

Did we learn our lesson in 1917 or have we forgotten it? With our Navy practically wrecked and ineffective, to satisfy Europe's demand for its own safety, and with our standing Army reduced to a mere shadow, where are we to look for protection unless it is to an air force that is immeasureably superior to any other military air force in Europe? To build up a new navy from the remnants now on hand will take years of time—not months. European powers saw to that, when they prevailed upon our credulity in the numerous pseudo peace conferences.

And now that we have had our cry out and have wiped our eyes, let us start remedying the matter immediately. It is the duty of the United States Government to look after the interests of this country and to protect it with the funds supplied by its citizens. We do not elect officials nor pay taxes for the purpose of promoting the interests of foreign nations when those interests are pointedly against our comfort and safety.

There are now many forces in this country working still further upon the credulity of the American citizen—forces organized for the pure and simple purpose of profiteering under the mask of building up our depleted air corps. They would stage a tremendous aircraft program, spending money without limit upon the purchase of useless airships, airplanes and similar equipment, when there is not the

most remote possibility of much of this material being put into service.

Spending money recklessly and foolishly upon unusable material is, as in past years, one of the favorite pastimes of our officials, but this latest proposed assault upon the treasury, the latest device of the lobbyists now at work in Washington, will far surpass anything that has yet been promoted in peacetime extravagance.

Selling the stunt to the public under the label, "America to Rule the Air," will appeal to the unthinking citizen who will countenance the enormous expenditures under contemplation — simply because he believes that such purchases are necessary for the organization of an air force. If, however, this citizen took a real interest in the matter as he should, he would be horrified at the waste of money engendered by any such program.

Just as one outstanding example of how to spend money recklessly, and without any fundamental reason at all, I point to the Navy's new dirigible, the "Akron," recently completed at a cost of many millions of dollars. A lavish expenditure of many millions tied up in a single questionable craft of no apparent purpose, which may be a total loss in the next big storm! And to complete the picture, a sister ship to the "Akron" is now being erected in its dock at Akron, Ohio.

And all of this expenditure in the face of the fact that Great Britain has definitely abandoned its dirigible program and has just junked the largest and finest of its dirigibles. If, after years of experience, Great Britain has discarded the dirigible idea and has run a road-roller over the finest ship in its fleet, then why in the name of all that's sensible should we start in building bigger and better dirigibles when there is little prospect of them ever being employed for any useful purpose?

It is probable that the "Akron," her sister ship and all of the equipment, will represent a fifteen million dollar investment—I haven't the exact figures before me. And all this money, so sorely needed elsewhere, is used to promote an idea that has proved of little value in war. And, further, the maintenance of such an airship, the expensive helium gas daily lost by leakage into the air, the ground crews, fuel, a million dollar dock for its stabling, and a hundred other items are daily burning up money.

And, if this pair of multi-million dollar airships do not become obsolete before the next war, then it is certain that they will be comparatively worthless weapons in five years by depreciation alone.

It is very doubtful whether a ship of the "Akron" type could successfully evade modern anti-aircraft fire. Further, I doubt whether it could survive an attack by a swarm of combat and attack planes, even though the dirigible is inflated with helium gas. In a few seconds or minutes, a flock of low cost midget planes could quickly sink the elaborate and helpless investment.

During the naval maneuvers near Panama recently, a dirigible was "technically destroyed" less than 30 minutes after it had left its base.

Again, we face a program (now under consideration) for a tremendous investment in airplanes of the most expensive type—a type that can be constructed successfully by only a few of the largest airplane plants in the United States. This vast fleet, running into more millions of dollars, is not a preparedness measure as its promoters would like to have us believe. It is simply a disgraceful method of wasting public funds. It would contribute to the prosperity of a few airplane builders, favored by the contracts, but it would not build up future resources in case of war.

If we were certain that all of the airplanes now under consideration could be provided with sufficient money for their proper operation and maintenance it would be another story, but taking a page from history, we feel sure that not more than a few of these ships would ever see the air, and then within a short time would be obsolete and offered at auction to the highest bidder at ridiculous prices. We have seen this sort of thing pulled off before in other branches of government activity, and therefore protest vigorously against any symptoms of the extravagance being repeated.

John B. Rathbun, managing editor of POPULAR AVIATION, *author of this article, has been connected with aviation since* 1909. *In* 1910 *he founded the first school of aeronautical engineering in the United States, and also entered into the manufacture of aircraft during this year under the name of "The Chicago Aero Works."*

In 1911, *he started "The Acme Aircrafters," an early engineering organization that operated until* 1921.

Mr. Rathbun is the author of two aviation textbooks used extensively by the United States and Canadian Governments during the World War, a considerable number also being sold in Great Britain.

During the World War, he was connected with the Department of Aeronautical Cognizance (civilian), engineering division, whose function was to analyze enemy aircraft. He was also connected with the U. S. Bureau of Inventions and assisted many inventors during that period, to develop their ideas. While thus engaged, he had an excellent opportunity to study the production of aircraft under wartime conditions.

Another editorial in this series from the pen of Mr. Rathbun will follow in an early issue.

Dream ships of the air without a sufficient appropriation to provide them with personnel, fuel, repairs or replacements. That is what the writer believes these planes to be. Money spent in abandon for equipment that will likely see the junk shop before service.

To build ship after ship is not preparedness unless the production of each of these ships is accompanied by the thorough training of at least three pilots for each of the ships so produced. Unmanned, by a trained personnel, they are totally and wholly useless.

Take as an example in the airplane field, the seven bombers recently announced in POPULAR AVIATION. These ships were sold to the Government at approximately $100,000 each, or a total of $700,000 for the seven ships. If the continued building of ships at $100,000 each is to be our program for aerial preparedness, then it is my idea that preparedness will not be much advanced before there is a decidedly large hole in the finances of this country.

Only ten ships to each million dollars, is either a slow way to build up an air force or a quick way to financial ruin. This is not written in criticism of any individual manufacturer, but it is a decided disagreement with the policies of the government officials in charge of aeronautic affairs.

It is our desire to protest against the proposed money spending debauch, the offspring of pork-barrel politics, now being furthered by the lobbyists. We must protest against the wanton waste of public funds such as represented by the purchase of $100,000 bombers and the multi-million dollar dirigibles, both constructed and under construction.

The sum now expended for one bomber — $100,000 — will purchase a great deal of useful equipment today. For example, $100,000 will buy forty primary training ships that we actually need. Again, this sum will provide adequate training for 200 secondary reserve pilots that are now the crying need of this country.

Multiply these figures by seven, the total number of bombers purchased, and we have an equivalent, in terms of useful merchandise, amounting to 280 primary training ships and 1,400 trained pilots. Is this something worth looking into?

Is all this high pressure promotion of prodigal shopping to be a repetition of the "Liberty" fiasco in 1917-1918 that cost this country millions of dollars? Are we to repeat the folly of the Liberty Motor, the Liberty Fuel, the Liberty Oil and sundry other silly "Liberty" adventures? Are the Follies of 1918 to be brought up to date and expanded into the "Follies of 1932?"

Government money and government assistance of various descriptions, is more needed for constructive aid to the aeronautic industry in general than for the immediate purchase of huge numbers of questionable super-ships. Its assistance is required for the relief of the smaller manufacturing plants and for establishing a liaison between the various units in the industry.

And this is just where the civilian training plan, advocated by POPULAR AVIATION, comes to the relief of the industry taken as a whole. By establishing a demand for the large number of training ships required for this program, the entire industry is benefited—not merely three or four of the larger plants.

Again, by assisting the airlines to

XUM

even a greater extent than at present proposed, data can be collected that will be of inestimable value in case of war. Data on the terrain, weather conditions and atmospheric characteristics in different localities are all easily obtained by the government in this way —mutually benefiting each other.

And now we get down to what, in the writer's mind, constitutes true preparedness. This consists in establishing a thoroughly trained personnel for flying the ships and sufficient funds for their maintenance.

Second, the building of such large expensive craft makes their construction possible only for a limited number of the larger manufacturers, whereas the construction of less elaborate ships opens the doors of the smaller aircraft works and thus leads to industrial preparedness. This can never exist with the whole situation held in hand by four or five of the larger plants.

In wartime production, every shop with even a limited equipment must be pressed into service, and to be effective, all these shops should have had previous experience in aircraft production. However, if all of the ships now being produced in peacetime are withheld from the smaller builders, then they will lack the necessary experience when war does arrive. Thus wartime production will again be delayed, just as it was in 1917 for a similar reason.

In spite of millions piled upon other millions in American aircraft production, our men still fought in Spads, Nieuports, Breguets, Camels and others of European manufacture. Practically no American ships saw service in the World War. Just about the time that our disorganized manufacturing system succeeded in putting the ships in the production line, that type became obsolete and it had to be done all over again.

You, our readers, have undoubtedly read many war stories in this magazine, but can you recollect any of the stories telling of American planes that took place in the fights? We will answer this question for you—no, you did not.

In short, preparedness then, just as today, is not simply a matter of ships in the field. The greatest peril lies in industrial unpreparedness which will continue to exist until ships are designed of such a type that they can be built by the multitude of small shops as well as the larger ones. And this is something to think of in regard to the present preparedness ballyhoo that is being raised simply for commercial purposes.

It has come to the ears of POPULAR AVIATION that a lobby has been in operation for some time for the purpose of influencing Congress in the matter of buying more and bigger ships. In my opinion, this is more than a simple rumor—it checks up too well with other information for me to consider this in the light of idle gossip.

Efficient and effective air forces are not built up by lobbyists, but extravagant expenditures are always the result of such maneuvers. The publicity features of the "bigger and better" type have been circulating for some time for public edification, and at one time or other, most of the newspaper and magazine editors have fallen for them.

Very recently, another and newer brand of propaganda has been spread about the country for public consumption. This is the most comfortable and satisfying propaganda imaginable, and makes us lean back in our arm chairs again — perfectly satisfied with things as they are. This widely spread assurance runs to the effect that we already have a sufficiency of pilots for wartime activities. All that we have to do is to mobilize all of our transport and air-mail pilots, and thus build up several hundred squadrons right away!

According to the misleading statistics dealt out, we already have enough pilots flying commercial ships—more than enough—to man a dominating air fleet. These, together with the private

(*Continued on page* 187)

PETITION
for
Free Civilian Training

We, the undersigned, petition the United States Government in the interests of National Defense:

(1) To refuse any further appropriations for the purchase of airplanes or airships which are designed for limited production at high prices—

(2) To organize a Free Civilian Training Plan by which boys and young men can be given flight training for future military service, should the necessity arise for their service—

(3) To encourage the mass production of popular type aircraft, trainers, and military types, of low cost and suited to the equipment and capacity of all aircraft manufacturing plants—

(1) *Name*.....

Street or R. F. D......

City.....*State*.....

(2) *Name*.....

Street or R. F. D......

City.....*State*.....

(3) *Name*.....

Street or R. F. D......

City.....*State*.....

(4) *Name*.....

Street or R. F. D......

City.....*State*.....

(5) *Name*.....

Street or R. F. D......

City.....*State*.....

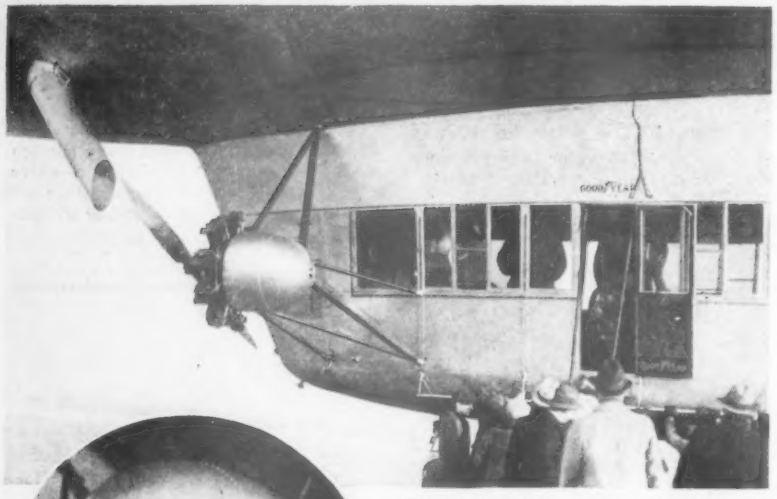
(6) *Name*.....

Street or R. F. D......

City.....*State*.....

NOTICE! Additional names and addresses may be written on an attached sheet—PASTED to this petition. Direct the petition to—JOHN B. RATHBUN, *Managing Editor*, POPULAR AVIATION, 608 S. Dearborn St., Chicago, Ill.

Advantages of Diesel Engines for Dirigibles



One of the Diesel engines mounted on the dirigible "Defender." Note the form of mounting.

Closeup of one of the "Defender's" Diesel engines from the rear.

AIRSHIP safety seems about to advance another step with the installation of Diesel motors for the first time on any lighter-than-air craft. They are used on the Goodyear-Zeppelin 183,000-cubic foot, non-rigid airship, Defender.

Two Packard Diesels, of 225-horsepower each, have replaced two 165-horsepower gasoline motors on the flagship of the Goodyear blimp fleet and will be tested all winter under observation of Packard and Goodyear experts.

Since Diesel fuel oil is not explosive, airship flight—already made nearly fool-proof by the use of non-inflammable helium lifting gas—will be made still safer.

And since Diesel motors produce greater mileage per pound of fuel used, the cruising range of airships will also be increased by their use.

If the Defender's new motors prove as successful as they now seem, it is probable that future Zeppelins of the Akron type will be powered with Diesel motors. With the use of economical Diesel fuel oil non-stop around-the-world flights are predicted for the big sky cruisers.

A Modern Breguet Goes Out For Distance

PICTURED below is the Breguet plane with which Paul Codos and M. Robida, French air aces, were making final preparations for a long-distance flight to Hanoe, Indo-China. Note the queer-shaped fuselage of the plane.

A late Breguet plane showing a girder extension for supporting the tail group.

A Historical Transcontinental Flight

AN AIRPLANE flight across the United States in the record time of 49 days—that was the achievement that had the whole country marveling just 20 years ago.

Veteran aviators recall the feat of Galbraith P. Rodgers on this anniversary. It was the first transcontinental flight, and it awakened an interest in aviation that has been growing ever since.

Rodgers started his historic flight at a Brooklyn, N. Y., race track, and he stuck to it through all kinds of adventures. He smashed against a hickory tree at Middletown, O., tangled with a barbed wire fence at Red House, Okla.; raced a black eagle across a stretch of Texas, broke up a circus performance at Lordsburg, Ariz., made a forced landing in a desert and was bothered by "ethereal asphyxia."

He was wrecked so many times that. when he finished in Pasadena, Cal., all that remained of his original plane were the vertical rudder and drip pan. All other parts had been replaced.

A few months after this epochal flight, Rodgers was killed in a crash off Long Beach, Cal. He was a cousin of Commander John Rodgers, skipper of the naval seaplane PN-9 No. 1, which in 1925, drifted nine days on the Pacific ocean after being forced down on an attempted San Francisco-Hawaii flight. Rodgers and his men were rescued by a submarine.

Bleriot Offers Prize Cup

MONSIEUR LOUIS BLERIOT, Paris, offers a high-speed flying trophy to be won before the end of 1935 by the pilot making the fastest speed in excess of 372.8 m.p.h. for half an hour at a time.

It can be won outright by the pilot flying half an hour at 1,000 kilometer speed (621.4 m.p.h.). The Schneider seaplane, with specially-boosted engine, made 408.8 m.p.h. last September, but the engine would not operate that long, having only a maximum of one hour's life.

California Not So Hot

SUNKIST California has also its arctic regions. The boys of Mather Field, Mills, California, have found that out. Determined to find out how high Califronian hot air rises, a squadron of P-12 pursuiters took off and nosed for points high, wide and handsome.

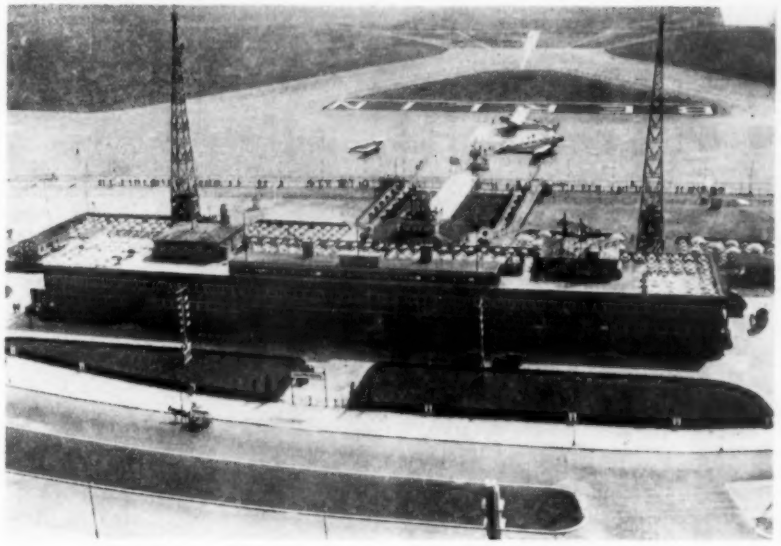
It was lucky they were bundled up in all the flying togs they could borrow or get in the good old army way. At 25,000 feet, California went North Pole. The perpetual warm climate of the ground turned to 35 degrees below zero. Oxygen apparatus kept the pilots breathing. But it took Californian sunshine to thaw out the icemen of the flying refrigerators.

XUM

Pleasure Flying In Europe Is a Nuisance

by GERALD B. BURNETT

An amusing tale of an American's eventful air-tour through Europe and the Near East. Between civilian red-tape and European regulations, this would have been an ordeal for anyone not possessed of a certain sense of humor that carried our hero through the mazes with flying colors.



The administration building and radio station at Tempelhof, Germany.

IF you are planning any sport-flying in Europe or Asia, make a great big portion of a good old American sense of humor the largest part of your equipment. Take it from Ross Hadley, Hollywood, California—you will need it. And Ross knows, for he spent fourteen months in sport-flying on the Continent and as far East as Singapore.

The American sport-flyer, accustomed to crossing State borders as he would cross Main street, has a rude awakening coming to him when he starts hopping about Europe. Governmental domination of aviation, bureaucrats and lack of private initiative, hold back the progress of civil aviation to the point where it is almost non-existent.

Flying over there is a business that belongs exclusively to the military and the civilian flyer—especially the foreigner—is looked upon as a decidedly suspicious character.

Hence the need for a sense of humor. As Ross Hadley reeled off his impressions of flying abroad it was easy to understand how an American, unblessed with the gift of seeing embarrassing predicaments purely in their lighter vein, might soon become a raving maniac or a center of international strife. Fortunately for Hadley he has a happy-go-lucky manner that permits him to pass through bureaucratic storms without an umbrella and emerge dry.

Flying since 1924 in and around California and the West, with many pleasure jaunts to the East, Ross had made a trip around the world via the steamship in 1926 and 1927. The country he saw abroad looked so interesting that he decided to see it more intimately from the air.

So on June 30, 1929, he took-off from Los Angeles in a Stearman C-3-B with Chet Loomis as a flying companion. Reservations had been made to sail from New York and the air-tourists planned to stop over en route at several cities visiting friends. Coming into Lordsburg, New Mexico, to refuel the ship, the bottom dropped out suddenly and the voyageurs crashed from sixty-five feet, completely washing out the ship but without personal injuries.

But here was a dilemma. The officials of the steamship company had arranged for the proper winding of the miles of red tape necessary to gain entrance for a plane, numbered "*8809*," into France.

Ross wired the factory to send him another plane immediately. As the wire was dated April 1, the factory manager thought Ross was up to one of his practical jokes and laughingly answered next day that he could not be fooled by any April wisecrackers. So gathering up the few special instruments left undamaged, and shipping the remains of the engine, the flying invaders of Europe took train for the factory.

The scene of the escape at Tempelhof, Berlin. Note the wide well-kept runways and the permanent construction of the buildings.

THE manager's embarrassment may be imagined when Hadley and Loomis stormed in with a handful of slightly worn instruments and a battered suitcase, demanding a plane. The sailing date was getting too close for comfort. So, while the factory labored to turn out the plane by day, the two flyers worked on it at night and soon plane number "*5310*" was ready. Without benefit of test flight, it was wheeled to the factory door, gassed up and flew away for New York.

Then began the first of the inevitable series of official consternation soirees. The papers showed that plane *8809* was to be admitted but this plane was

number *5310*. Such a thing had never been heard of—it could not be permitted, etc., etc., and so on, far into the night.

Nevertheless, when the ship sailed, *5310* was safely on the promenade deck with two dauntless fliers alongside.

The plane had literally been torn apart at New York in the rush of getting aboard. Landed at Havre, and moved to the flying field of the Aero Club d'Havre, the amateur riggers discovered that the instructions for reassembly had been sent to Paris. So they went ahead and put it together again as best they could. The result was a right wing heavy and the first test flight made by Ross revealed several other unique effects.

A large crowd of Frenchmen had assembled to see the crazy Americans fly. Ross roared off the runway, zoomed straight up, banked and turned over on his back unexpectedly. Flying across the field upsidedown he fought to right the plane, slid off into a spin and came out of it just in time to sit down rightside up.

While he was replacing heart and stomach in their proper places, an excited gentleman in a duster, and with a long gray beard, rushed across the field waving his arms and shouting. Oh, oh, thought Ross. Here comes the French Department of Commerce inspector, or his equivalent, to bawl me out for flipflops.

But after much embracing, gesticulations and fervid spouting of incomprehensible language, an interpreter made it plain that the old gentleman was the Aero Club president. He was congratulating Ross on his remarkable exhibition of stunt flying and Ross was forthwith made an honorary member of the club.

SO, with the stick way over to one side to compensate for the queer job of rigging, the newly honored flyers took-off for Paris and the instruction book.

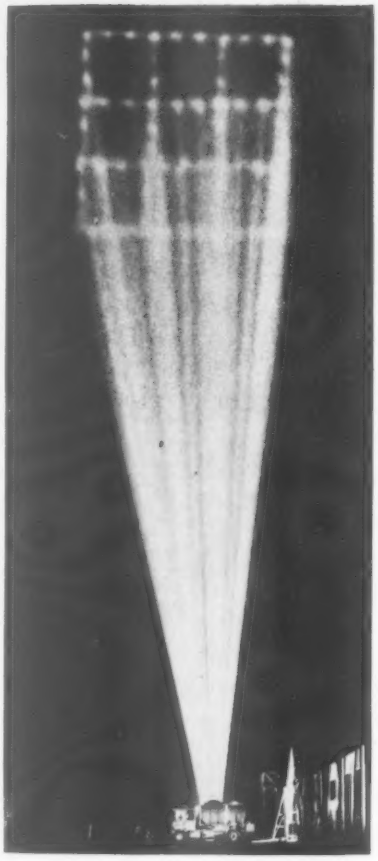
It is now possible to secure a well known standard brand of American aviation gasoline almost everywhere in Europe, but it was not then. Consequently every flyer had to work out a formula suited to the digestion of his own engine and attend the ceremony of mixing it to make sure that he received the correct proportions.

Arrived at Paris, Ross had the formula he had evolved at Havre after several sad experiences. But someone in Paris evidently did not agree, for en-route to Marseilles, Ross found that he was burning thirty gallons per hour. Finally, after dint of much misunderstanding on everyone's part, he secured an automobile essence of the premier grade with a twenty percent mixture of benzol which seemed to satisfy the J-5. The Rumanian gasoline used extensively in Europe just does not agree with American motors.

On May 17, the inhabitants of Mar-

(*Continued on page* 186)

Pillar of Light



The pattern of light enables anti-aircraft guns to locate a marauding enemy.

MAJOR Jack Savage of London, England, has invented a unique anti-aircraft searchlight, which, in addition to being the most powerful in the world, throws its beam in the form of a hollow grid and enables enemy aircraft to be sighted at once. At the same time, the searchlight determines the height, speed, and direction of the plane. The photo shows the beam being projected to show the form of its cross section, at London, on Dec. 5th.

Kaiser's Grandson is Now U.S. Pilot

PRINCE LOUIS FERDINAND VON HOHENZOLLERN, grandson of the former Kaiser, now has a new title—that of licensed airplane pilot.

Prince Louis Ferdinand, who was born a Prince of Prussia and was awarded a "Ph.D" by a German University, has been employed for many months by the Ford Motor Company. The son of the former Crown Prince became interested in flying and recently completed a six week's course. Immediately upon securing the required number of hours, he passed the Department of Commerce tests and was awarded a private pilot's license.

He Puts a Sub Out of Business

MANY odd stunts were performed during the World War—not a few of them through sheer luck. One of them was the "blinding" of an enemy U-boat by a British aviator.

During the submarine blockade, a British flyer was crossing the English Channel and noted two destroyers on the water below him. At the same time, his observer saw the periscope of a submarine a half mile away through his binoculars. The next minute there was a long narrow streak of white foam from a torpedo going at a terrific speed toward the foremost destroyer, missing the stern by a hairbreadth.

At once, the destroyers began firing at the U-boat, but a narrow periscope tube two feet above the water and a half mile away, was a difficult target to hit. Another torpedo foamed its way toward the foremost ship, to be followed by others which would be sure to find their mark eventually.

The airman's only weapon was a heavy Mauser revolver, but a brilliant idea came to him. He sped toward the U-boat, and when almost directly above it, he swooped down in a nose-dive. In straightening out, he passed not more than twenty feet over the periscope. As he did so he aimed his revolver at the slender tube and fired six shots. The next instant his observer, peering down through his binoculars, let out a wild shout. By sheer luck the pilot had hit the periscope and shattered its lens!

Immediately the U-boat disappeared from sight. Months later, the birdman had the satisfaction of learning that the day after his plucky exploit, an enemy submarine had returned to its base. Its chagrined commander reported that he could easily have sunk two British destroyers if it hadn't been for a pesty British flyer who had blinded him by breaking the lens of his periscope with a miserly revolver!

A Crash Experiment

ARTHUR SAUVANT, young French aviator, likes to experiment.

Likes it so well, in fact, that when spring comes he is going to risk his life in an attempt to prove he has a good idea.

Sauvant, in an airplane he has constructed himself, will deliberately crash the ship from a height of 3,000 feet to show that in planes built like this, accidents will not result in loss of life.

In a model of the plane which he will use he has dropped a live sheep from 500 feet, and while the model crashed to pieces, the sheep emerged safe and sound. A basketful of electric light bulbs survived a similar fall.

While Sauvant has refused to divulge his principle of construction, it is apparently that of a double wall, like a hen's egg inside an ostrich egg.

Sauvant has held a French pilot's license six years.

XUM

Dead Stick Landing With Autogiro

RUNNING out of gasoline, because of headwinds of unsuspected strength, the pilot of a Kellet autogiro recently experienced a night "forced landing" from 2,000 feet, entirely without precedent in its illustration of the security offered by certain types of modern aircraft.

Leslie Cooper of Roosevelt Field, pilot of the machine, had the weird experience while flying through the darkness from Albany to Syracuse, New York. He said of the incident, "Suddenly the motor coughed and stopped, completely out of gas. Embarrassing to say the least. The ground below was absolutely black and it was impossible to distinguish whether we were going to land on trees, deserted houses or what have you.

"There being only one thing to do, I headed into the wind, the direction of which I knew pretty well from watching my drift while following the beacons—and came down vertically two thousand feet.

"We landed in the backyard of a farm house with no more shock than the average landing and without forward roll of an inch. The wheels landed in a one-foot ditch, which with any movement of the ship would have turned us over. Actually, there was no damage done to the ship whatsoever.

"Had we been in an airplane without flares and landing lights, making contact with the ground at fifty or sixty miles an hour, the results would have been different to say the least!"

The publishers of POPULAR AVIATION *are pleased to announce their new magazine,* PRACTICAL MECHANICS.

PRACTICAL MECHANICS *will bring a brand new idea in the publishing business, different from any other magazine you have ever seen.*

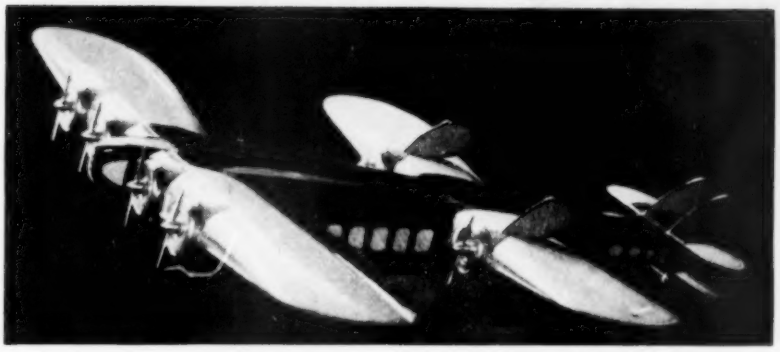
PRACTICAL MECHANICS *will be so different, in fact, that no information on its appearance will be given out until it appears on the news stands, Feb.* 15.

Just as a hint, it will carry large scale blue-prints and detailed instructions showing how to build models and lightplanes as well as fascinating dips into electricity, television, chemistry, home-craft, etc.

PRACTICAL MECHANICS *will be on sale at all news stands, on or about Feb.* 15, *and you are invited to pick up a copy and inspect it.*

Incidentally, the editor of POPULAR AVIATION *is also one of the editors of* PRACTICAL MECHANICS, *and he would like to have your opinion on this new publication.*

The Modern Capelis Tandem Monoplane



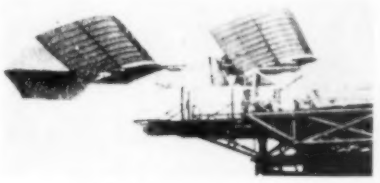
An overall view of the Capelis tandem monoplane.

DATING back from Langley's time, the tandem airplane has always been a favorite dream of the inventor and designer. This type of ship has wings that are arranged in fore-and-aft relation, the idea being to support a long roomy fuselage at both ends. The individual wing groups may either be monoplane, biplane or triplane arrangement.

The latest entry into the realm of the tandem plane is the new Capelis ship pictured here, which was recently developed on the Pacific Coast. This is a tandem monoplane equipped with six wing motors and is therefore a very modern type.

It will be noticed that this type of plane makes a very much longer cabin possible, and therefore permits of a much greater seating capacity than ships equipped with a single wing group. It is likely that the length of the cabin can be increased from three to four times the length of the present single group type.

In the case of the Capelis ship, the take-off is greatly assisted by mounting the engines on universal joints so that the propellers can be pointed up, giving additional lift.



The early Langley tandem plane.

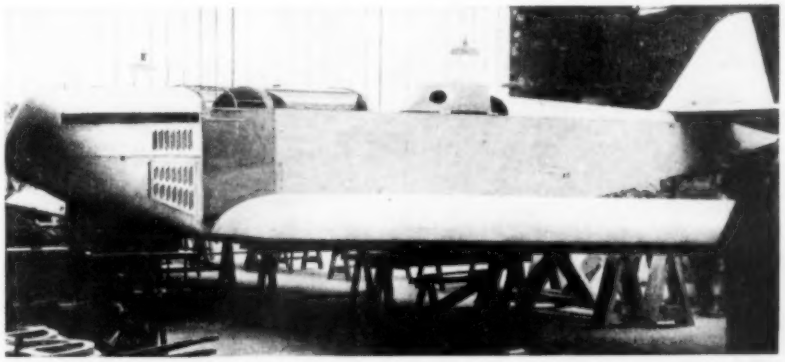
A Recent French Stratospheric Plane

THIS is the "stratospheric" plane now nearing completion in the workshop of M. Guerchais, French aeronautical engineer, at St. Cloud, near Paris. It is of special interest at this time because the Farman stratospheric plane soon will undergo its initial tests.

The Guerchais machine (we don't dare call it a "ship") is of the same general type as the Farman. In it, the French scientist hopes to penetrate the stratosphere, or "Earth's envelope" in record time that will make the recently successful balloon ascent seem like a snail's pace.

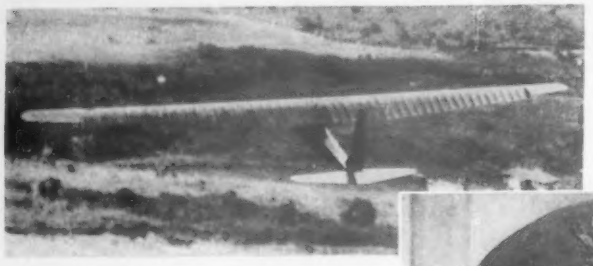
M. Guerchais expects its 700 h.p. motor to attain a speed of 200 miles an hour and thus to reach the stratosphere, ten miles above the earth's surface, in forty minutes.

In the photograph may be seen the nose of the plane with its hermetically sealed cabin upon which (and upon the oxygen supply within) the lives of stratosphere explorers will depend.



A view of the uncompleted fuselage of the Guerchais stratospheric ship.

Lieut. W. A. Cocke Breaks Soaring Record



At left, is the soaring glider "Nighthawk" with which record was made.

• • •

Below is Lieut. W. A. Cocke, holder of the present soaring record.

Cocke Breaks Soaring Record

LIEUT. WILLIAM A. COCKE, United States Army Air Corps, shattered the world distance and endurance record for gliders after flying twenty-one hours and thirty-six minutes in his yellow "Nighthawk."

He created the new world distance record with approximately four hundred miles, the former record being 283.22 miles held by Germany. The previous endurance record made by Ferdinand Schultz in Germany was fourteen hours and seven minutes.

Cocke established his record in Honolulu, December 18. His flight was made in the national glider meet competition, under the auspices of the National Aeronautical Association.

Cocke is a second lieutenant of the 18th Pursuit Group, Air Corps, United States Army, Wheeler Field, Hawaii. He received his primary aviation training at Brooks Field and his advanced training at Kelly Field, San Antonio, Texas. After his graduation from the advanced training center in February, 1930, he left for his new station at Wheeler Field.

The young flyer is also a designer. He built the "perfect flying wing," as his associates call it. Each day for months during off-duty hours Cocke tugged his glider from its shelter and spent much time long after day ended working on his discovery.

He perfected a glider which has no tail at all. By doing this he gave pilots' greatest enemy—wind resistance—a severe blow.

"It has no exterior appendage, no tail piece," he explained. "The purpose of this is to decrease the parasitic wind resistance; in other words, that resistance which contributes nothing to the buoyancy of the plane."

Even aviation, with its spectacular combat acrobatics, military maneuvers and aerial warefare, becomes monotonous. "Not that I don't enjoy it," Cocke admits, "but I just turned to gliding for new thrills."

As a result of his quest for a new thrill Lieut. Cocke holds the world glider record.

An Old Gordon-Bennett Racer

'WAY back in 1920, the Dayton-Wright Airplane Company built an American entry for the Gordon-Bennett races. It was designed by Milton J. Bauman under the supervision of Col. V. E. Clark, and possessed several startling features for the time.

In the first place, the wing was of the variable camber type by means of which it was hoped that a better speed range could be had. Further, it was fitted with a retractable landing gear in order to reduce the head resistance. It was not definitely known how fast the plane could travel, but the top speed claimed for it was 180 m.p.h.

The variable camber wing was built up of several "I" section balsa spars, placed edge to edge and covered with plywood. The leading edge was hinged so that it could be dropped or raised in order to increase or decrease the wing curvature or "camber."

The trailing edge was also arranged for adjustment of curvature so that a very distinct variation in the wing section could be had by the pilot. The variable trailing edge could be also used as an aileron.

As the pilot's forward view was cut-off by the Hall-Scott engine, the glass in the windows was bulged out slightly so that a better view could be had than with flat glass. This ship was unusually well streamlined and every attempt was made to cut down resistance.

A Gas Pressure Regulator for Dirigibles

THE problem of maintaining the proper air pressure in non-rigid airships at all times during flight has frequently proved a difficult one. Letting out or taking the proper amount of air into the ballonet has, up to the present time, been a manual operation.

During rough weather, the gas pressure is subject to more or less rapid fluctuations which cannot be readily adjusted by the pilot. In such instances, this pilot has realized that an air pressure control, automatically operated, would prove not only more efficient from the point of view of the airship and flight, but would relieve him of one more task in an unsteady airship car.

Such an automatic air pressure control has been designed by the Material Division engineers, and is scheduled for immediate construction and testing. This device makes use of the fluctuating pressure within the airship envelope to regulate automatically the distributing of air to the ballonet.

Steam Heat for Transport

THE first steam-heated airplane in the country will be on the new scheduled run between Louisville and Cleveland. The plane is a Pilgrim 100 A, manufactured by the American Airplane and Engine Corporation.

The steam heating apparatus is remarkably small, weighing, liquid and all, but 32 pounds. It consists of a tiny boiler, similar to those used on larger heating plants, but instead of radiating heat from fluted radiators in the cabin, fresh air is first heated by two small radiators and is then fed into the cabin.

Engine exhaust flames are used to heat the boiler which is placed in a small pipe forming an elbow on the exhaust pipe. The boiler contains Prestone, of which five and a half quarts are used in the entire system. Since the boiling point of Prestone is 315 degrees, the temperature of the boiler vapor is 340 degrees. There is an automatic thermostat which regulates the amount of exhaust heat that goes into the flues of the boiler.

In the leading edge of each wing, near the fuselage, there is a duct for fresh air, the air being forced into the cabin by the forward movement of the plane. Between this duct and the cabin are the radiators, which preheat the air before it reaches the cabin.

The amount of hot air which may be forced into the cabin can be regulated by the passenger, just as the individual ventilators are controllable by each passenger. In addition, the pilot can regulate the total flow of heat into the cabin or the heat supplied to his cockpit.

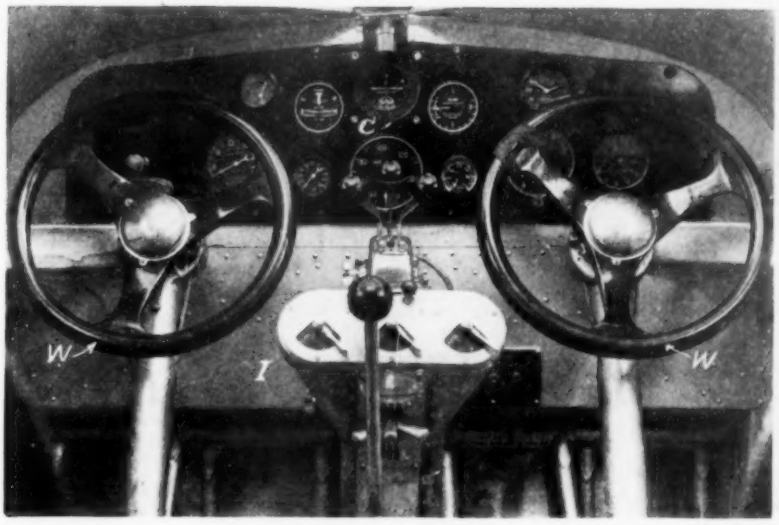
There is no possibility of any fumes getting into the cabin. Nothing but fresh air is drawn over the radiators.

XUM

The Instrument Board Explained

by **L. J. VAN SICKLE**

A simple yet acurate description of the many complicated instruments used for the navigation of a large airplane. By means of these devices, the pilot can determine his speed and direction accurately.



A view from the pilot's seat on a dual controlled ship, showing the instrument board used on a modern mailplane.

MODERN developments in airplane instrument design have contributed much to the safety and certainty of flight. They have eliminated the errors and frailties of human judgment and have introduced mathematical precision into the piloting of a plane.

Piloting a plane and driving an automobile are two entirely different propositions. The motorist needs only enough instruments to gage his speed and to tell him certain facts about his engine. The pilot, on the other hand, must have additional information because he is moving in three dimensions instead of one. He must know his altitude, speed, engine r.p.m., lateral attitude, longitudinal attitude, direction of flight (by compass) and a number of other facts to be detailed later.

At first, flying was by purely instinctive control as dictated by the senses of sight and feeling. This was sufficient for short distances covered in the early days, but is totally insufficient for modern long distance and all-weather flights.

Once flying had advanced far enough, so that it was possible for an airplane to fly far from the point of taking-off, and high above it, it became necessary to devise instruments to indicate position, altitude, and direction of flight. The first effort, therefore, at indicating what the airplane was doing was the adaptation of instruments used in other lines of scientific endeavor.

For direction of flight, an ordinary magnetic compass was mounted where it could be seen by the pilot. For altitude, an aneroid barometer was regraduated in feet of altitude instead of inches of mercury. Tachometers, or revolution counters, had been used in various forms for years. Therefore, mounting them on the engine of an airplane was not a difficult proceeding. Ordinary pressure gauges could be used to indicate fuel pressure and oil pressure, while various forms of thermometers gave indications of the engine temperature.

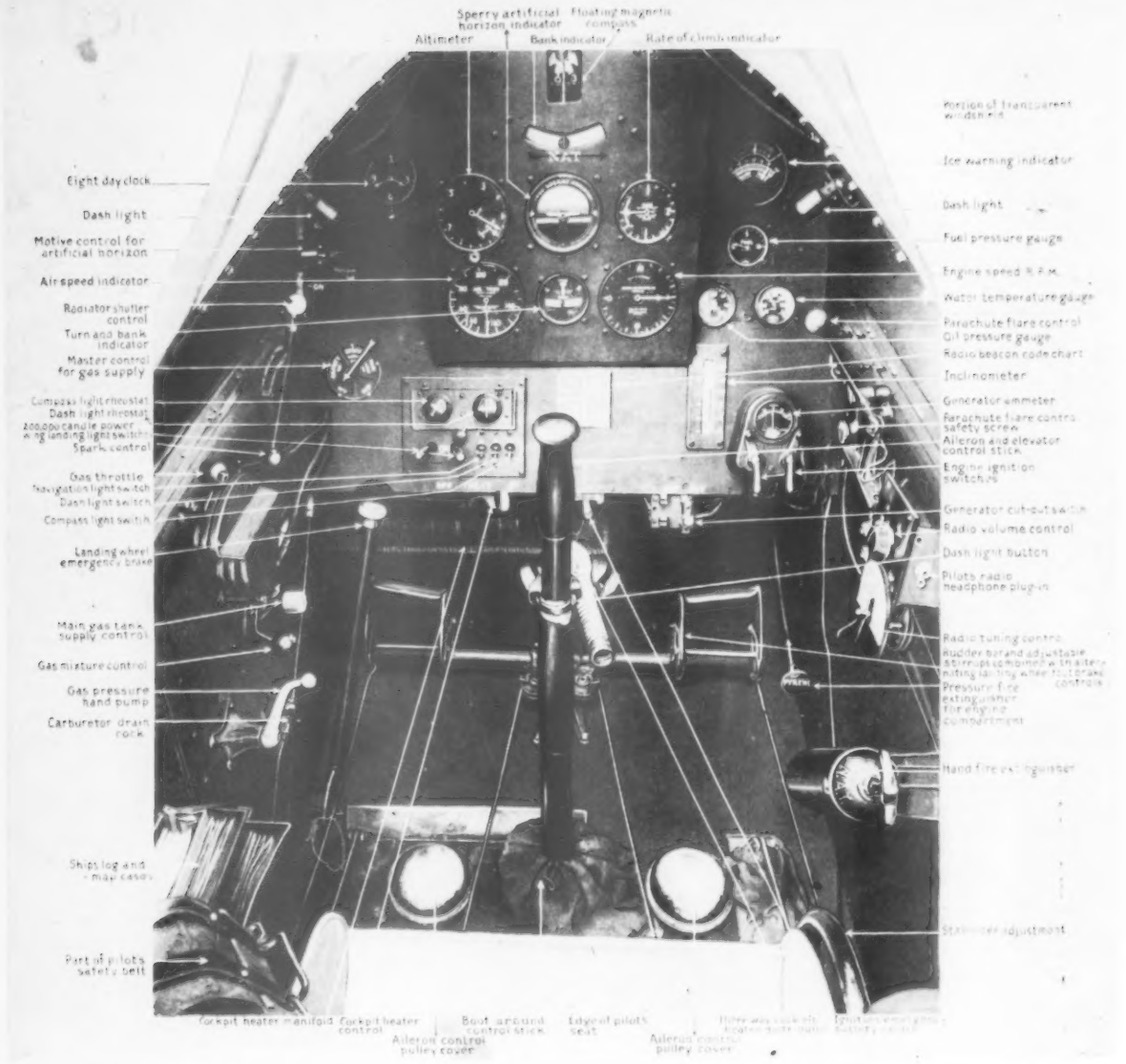
For military planes, these instruments were deemed sufficient, when they were aided and abetted by what was called "flying instinct." This flying instinct was regarded as being absolutely indispensable to the war-time pilot. He must by some sixth or seventh sense *know* that he was flying correctly; he must sense that his ship was flying level—neither climbing nor descending.

If he wanted to reach his hangar safely he had to have this instinct for direction and location. He had little confidence in the accuracy of his instruments. They were either too sensitive or not sensitive enough. Especially was this flying instinct called into play in night flying. The success of so many of these flights was little short of miraculous.

The present-day pilot can fly successfully for hundreds of thousands of miles and not possess a great deal of this instinct. To replace this flying sense he has instruments of all sorts which are constantly being checked. He knows they are reliable and he would not trust his instinct against the indications of these instruments.

Tests have proved that a plane in a tailspin may come out of the spin without the pilot's being aware of the fact. The fluid in his ears, which provides him with a sense of balance, may be giving him entirely false impressions. He may set the controls to counteract the spin and yet throw the ship into a fatal reverse. But if he watches his instruments he cannot go wrong. They

Details of a Telepoint Compass. The dials in the upper corners indicate the direction that the ship is taking, while the knobs in the lower corners are the electrical controls. The generator is in the center.



A complete indexed chart of the instruments and controls used on an airplane equipped for blind flying. The control "Stick" is shown in the foreground with the rudder pedals just below it.

show the precise instant when the spin ceases.

AMUNDSEN in his polar flight, and Lindbergh in his transatlantic hop, used the "earth-inductor" compass and brought it to instant fame. This instrument replaces or complements the magnetic compass. There are several reasons why the magnetic compass was deemed unsuitable for long flights.

In the first place, the magnetic compass is a direct-reading instrument that must be mounted where the pilot is, it must be mounted where the pilot can see it. Mounted directly ahead of him it is subjected to the interference of the magnetic materials in the engine. In the second place, the magnetic compass is subjected to what geographers and civil engineers call "magnetic declinations." It always points to the magnetic North Pole, which, in most locations on the surface of the earth, does not coincide with the true North.

If the magnetic North were a constant angular distance away from the true North, means of compensating for distance could be devised; but this distance (called the declination) varies from place to place.

So, if Lindbergh had set off from his starting point, depending upon a magnetic compass to bring him into Paris, he might have landed there, but, again, he might have landed as much as three or four hundred miles from Paris.

The earth-inductor compass is free from these two handicaps. In the first place, it is made up of three principal parts: a generator, a controller and an indicator. The generator is mounted in the tail of the plane, away from all magnetic disturbances, and the indicator, mounted on the instrument board, can be shielded from such disturbing factors.

The indicator is simply a sensitive galvanometer. The controller is a device for shifting the brushes on the generator. The generator is a revolving armature with a set of two brushes. The magnetic lines from the two magnetic poles of the earth furnishes a field which is cut by the conductors of the armature. The armature is rotated by a small air-turbine, and by the vacuum furnished by a venturi tube mounted on an exposed surface of the plane.

Before beginning the flight, the plane is pointed on its proper course, being checked by the magnetic compass and corrected by taking account of the known declination. Then, by racing

the motor, a wind current is forced through the venturi tube and a vacuum is established in the air-turbine. The pressure of the external air then forces tiny jets of air against the blades of the turbine and the armature rotates.

THE brushes on the armature are electrically connected to the indicator and are adjusted until the galvanometer reading is zero. Now, so long as the plane's nose is pointed on this true course, the galvanometer reading will continue to be zero. If the plane turns off this course, more or less of the earth's magnetism will be cut by the revolving armature and the indicator will move to the right or left, depending upon the direction of the turn. This particular instrument is quite an intricate affair, and if it is to function properly it must be handled with extreme care.

Another instrument, which has come to be regarded as a necessity to safe flying, is the "bank-and-turn" indicator. In reality, this consists of two separate instruments, built together in order that they may be observed simultaneously. The bank indicator consists of a curved tube filled with a non-viscous liquid in which is immersed a small steel ball. This tube is mounted in such a way that when the wings of the plane are level with the horizon, the steel ball rests at the bottom of the tube. When either wing drops, even slightly from the horizontal, the ball moves to the same side, thus indicating which wing is low.

When the plane is properly banked for a turn, however, the ball remains in the middle of the tube, even though the wings are at almost a vertical angle. This is due to the centrifugal force exerted in the turn which, if the plane is correctly banked, will hold the ball in the center of the tube so long as the plane does not slip nor skid. If the bank is either too flat or too steep, then the ball will indicate the fact. This bank indicator is called also a lateral-inclinometer.

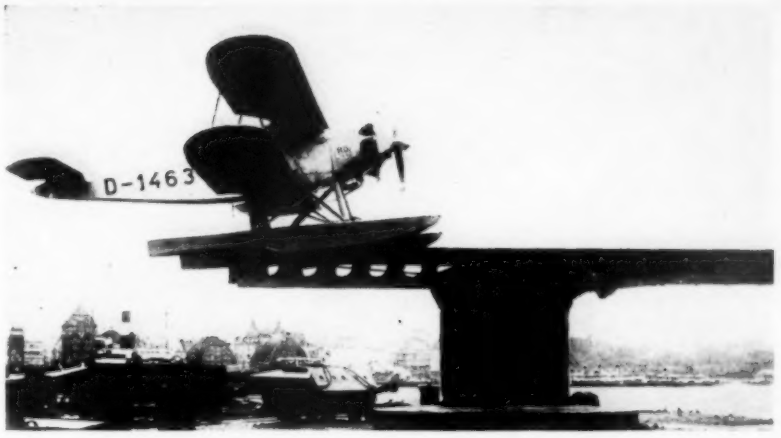
The turn-indicator is a much more complicated affair. It is a gyroscopic instrument and extremely sensitive. A gyroscope—familiar to most of us in the form of a gyroscope top—is made up of a rotor which turns about an axis. Its supports, which permit the free movement of the rotor, are generally in the form of gimbals, similar to those used to support a ship's compass.

The gyroscope will maintain its position so long as the rotor is revolving and will oppose any force which tends to move it from this position. In the turn-indicator, the rotor moves with a speed of about 12,000 revolutions per minute. Tiny blades are cut into the circumference of the rotor and it serves the purpose of a turbine wheel as well.

Like the generator of the earth inductor compass, it is actuated by a vacuum produced in a venturi tube.

(*Continued on page* 190)

Seaplanes Launched by Ground Catapult



A biplane mounted on the catapult runway, ready for starting.

DETAILED reports are not available on this new type of airplane catapult, now being tested in Germany, but the ship shown perched on it and ready to be hurtled into the air has a sort of confident appearance. This photograph was taken in Kiel where the new catapult was built in the Deutche Werke and where the testing is in progress.

Just a Friendly Bout in the Clouds

WHILE in a multiple parachute jump for a motion picture news reel, Sergeant Levi C. Schneider and Sergeant Lloyd T. Burval exchanged greetings in a cloud. They decided that neither cared for the other's immediate company under the circumstances, parted after strenuous efforts and meticulously avoided each other during the remainder of the descent.

Five men jumped from the Chanute Field Transport at an altitude of 6,500 feet, for the purpose of permitting newsreel photographers to take motion pictures of the five parachutes descending into clouds and emerging from the bottom of the cloud bank. The wind at that altitude was estimated at 50 miles an hour. Sergeant Schneider jumped third, after Sergeant Burval had preceded him as the second to jump.

The soldiers cleared the ship properly, and the parachutes functioned in a normal live opening. Their objective, a large white fleecy inviting cloud about 1,500 feet thick, lay 1,000 feet below them and to one side. Intent upon kicking holes in the cloud with their feet, the two jumpers carefully watching their direction, slipped their chutes.

Just as Sergeant Schneider was within nice kicking distance, about to release his risers and float into the cloud, he received one of life's thrills by suddenly finding one pair of army issue shoes directly in front of his nose. By the size and general contour of the shoes, he at once recognized his friend, Burval, who also had been intently navigating toward the cloud.

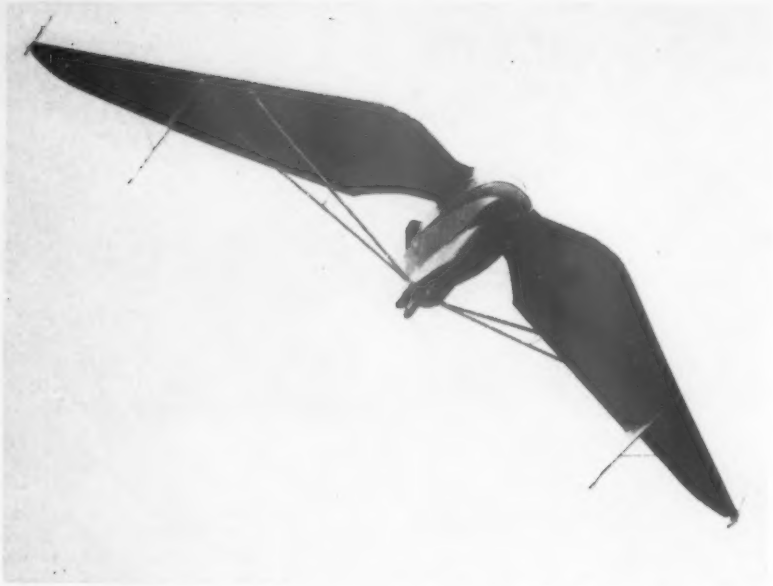
Due to the high wind, the parachutes were oscillating violently, and before the two men had a chance to separate, Burval was thrown through Schneider's shroud lines, his legs and body becoming entangled by the cords which wrapped around him. Both chutes had, by this time, been allowed to open full, but Sergeant Schneider's chute was flattened on one side by the lines of the other chute. He began to drop more rapidly, dragging Burval with him, the tangle becoming more severe.

As this happened, a hole was torn through one panel of Schneider's parachute, causing it to fall still faster. Both had reached their objective together. They were in the center of the milky white cloud, and each violently wished that he or the other were somewhere else.

Burval, jammed against the torn canopy of Schneider's parachute with many silk lines around his legs, while both chutes were oscillating wildly in the center of a white soupy cloud, held the shrouds out from him and slowly disentangled himself. Finally he was free and swung away. But before they could effectively separate, they were again thrown together in oscillation.

By this time each man was tired of the sight of the other and longed to get out of that cloud where such aerial combat was unfair. Each took immediate steps to hunt some other portion of the atmosphere. Burval slipped one way, while Schneider with his torn chute fell away rapidly—slipping out of the cloud in another direction. Burval dropped 500 feet below Schneider, who decided that there was no disgrace in remaining higher. Both then made normal descents.

An Improved Cabin Type "Pterodactyl"



The "Pterodactyl," Mark IV. in flight, showing the peculiar birdlike wings of the ship. As will be seen, this is a tailless type in which the back-swept wings take over the functions of the usual stabilizer and elevator.

UNCANNY like a large bird poised on motionless wings is the tailless "Pterodactyl" monoplane, the latest model of which is about to begin renewed flying trials. Developed in years of endeavor by Captain G. T. R. Hill with the help of the Westland company, the strange craft represents one distinct line of approach to the design of an airplane endowed with exceptional speed range and controls which remain fully operative after the "stall" —the moment when flying speed is lost and the machine can no longer sustain itself in level flight. Slotted wings and the gyroplane (or "windmill") constitute the chief other ways to solution of the problem.

The new "Pterodactyl," styled Mark IV, is a shapely cabin craft for three occupants, powered with a single 120 horsepower inverted air-cooled engine placed at the rear of the cabin. This engine location, with a "pusher" propeller instead of the usual "tractor" in the nose, helps the designer in streamlining the cabin, provides unusually good view for the pilot and reduces the noise heard by the passengers. Full performance data of the new plane are not yet released, but it is known that the top speed of this unorthodox machine is around 110 miles an hour.

In the absence of the usual tail unit, fore-and-aft as well as lateral control is obtained through "controllers" located at the extreme tips of the wings. Vertical rudders are mounted above the wings; the airplane is steered by moving either rudder independently, and operation of both rudders simultaneously to present a surface broadside on to the wind provides a powerful air brake when gliding in to land in restricted spaces.

The undercarriage is novel. Two wheels are mounted tandem fashion on a rocking frame below a shock-absorbing leg, an arrangement which allows of easy riding on bumpy ground. On the ground the pilot steers the airplane by turning the front wheel as he would a bicycle wheel; the wheel brake acts on the rear wheel only, eliminating risks of overturning caused by too sudden application.

A streamlined casing covers the entire undercarriage; with this case the "drag," or air resistance, of the undercarriage is reduced so much that the makers claim performance with it almost equivalent to the speed and rate of climb that they might expect to gain by making the undercarriage retractable within the body of the aircraft after taking off.

Inside the small, but comfortable, cabin the pilot sits in front with windows all round him and large roof light. The two passengers sit side by side behind him. Between them and the engine is a big luggage compartment, and there is room for parachutes. Altogether, a machine of which the light airplane pilot will hope to hear more as time goes on.

This is another startling addition to the popular type of tailless airplanes that are awakening such interest in both this country and Europe. With so much experimental work in progress along these lines, it would seem reasonably certain to get some results in the immediate future.

Races Wild Ducks—and Loses

WHAT was at first considered great sport for Henry W. McEnery, later turned out to be quite a pain—not only for potential duck hunters of the vicinity but also for McEnery. McEnery not only violated County and State laws during his flight, but also the Federal Department of Commerce regulations governing flying.

After circling about Lancaster Airport for some time, McEnery and his flying companion sighted a flock of wild ducks. Being tired of straight flying and in search of excitement, according to his later statement, the youth took after the flock with his plane, chasing them far across the country.

These ducks however, were the particular proteges of the Lancaster Gun Club which had enticed the ducks to the vicinity with the object of having them on hand for the opening of the duck season.

Quick protests by the secretary of the Club brought Capt. Morgan of the sheriff's office to the field, where the officer met the pilot on his return to earth.

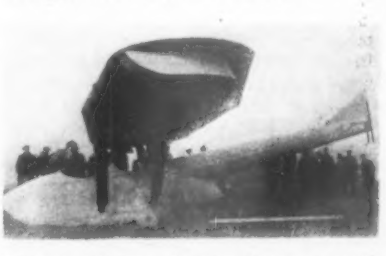
McEnery, according to Morgan who later interviewed Inspector Hazen of the Department of Commerce anent the case, violated the law when he carried a passenger; when he flew far beyond the five hundred foot safety limit; when he flew far beyond the gliding range of his airport. He was also piloting an unairworthy plane.

McEnery must have his plane reconditioned and must stay on the ground for a period of ninety days as a reminder of his jaunt. By the end of the ninety day period, the duck season will have gone and Lancaster hunters will have the chance of enticing the wandering ducks to home again.

Some People Prefer Getting Bumped by Water

LOWE WYLD, noted gliding expert, is inventor of this sea glider. It was built in Hendon, England, "Successful tests have been made on the Welsh Harp," the news reports declare. Judging from this location, and the way Mr. Wyld's name is spelled, we judge he is a Welshman. "High Wild" would be more suitable for a glider fan—perhaps.

Annyhoo, the sea glider takes off by being towed over the water.



An improved aqua glider employing a nacelle and streamline tail boom.

Uncle Sam Hunts Up a Promising Inventor

The story of a wild goose chase
by CAPT. CHAS. W. PURCELL

MISTER U. S. Aeronautical Branch of the Department of Commerce, Oakland, California.
Dear Sir:

I have recently completed an aviation invention that will soon startle the world. Before putting this on the market I will allow someone from your office to see it.

It is an airplane of the future, built to land on the deepest ocean, the coldest ice, and the whitest snow. It uses no gas or electricity but takes its forces of propulsion from nature herself.

The National Guard of this city has been called out to guard the secret of its construction. The U. S. Secret Service has offered its services but we feel that the National Guard will be all that is required.

I am telling you the above just to show how important this invention is. Foreign nations have endeavored to buy this, sight unseen, and several have tried to steal it.

I await your immediate reply.

Signed by,
The Town Councilman,
His Honor the Mayor,
One Alderman,
Six Small Boys.

A letter something on this order arrived at the Aeronautical Branch of the Department of Commerce at Oakland, California, and Bill Moore, the inspector who received it, jumped up from his desk and grabbed his bear skin flying suit.

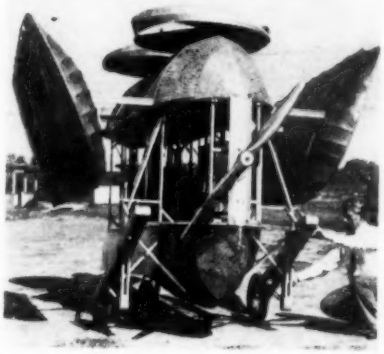
"Boy, what a break. Here's something good and I'm going to be in on the discovery."

He got himself so worked up thinking of it as he put on his flying suit that he tried to put his leg where his arm should have gone.

"Hey, Mrs. Ferguson, will you call the hangar and have them warm up the ship for me?"

Bill finally got himself all wrapped up in bear skin and rushed out on the field. He had several more busy moments trying to fit somebody else's chute pack to his anatomy.

The inspector then climbed into his antiquated crock — (the depression seems to have hit the Department. Most of their ships are three years old and just about ready to fall to pieces. These same ships in the hands of anyone else would draw "thumbs down" from these same inspectors. What's the matter with some of you airplane salesmen?)—and hit out for a Northern California city where the writer of this letter lived. When I say hit out, I mean he was doing a full



One example of many somewhat similar examples, of what a good inspector must inspect.

80 miles an hour (top speed of the Department's crocks of the air). He hoped the panels would stay with the ship until he got to his destination. The way his ship was shivering and shaking he had his doubts. Bill didn't mind dying but he wanted to see this invention before he joined up with the rest of the Department of Commerce Inspectors shoveling coal.

OLD man Moore battled snow, ice, rain, thunder-bolts and lightning, but he finally arrived at his destination top side up. He refused to take into consideration a funny acting stabilizer. and a couple of ailerons that the ship apparently lost on the way. The author noticed the two first fingers on Mr. Moore's right hand are always held in a crossed position, and after seeing the department's ship in the air no further explanations were necessary.

Bill jumped from his ship before it stopped rolling after making a fairly good landing, considering the shape the ship was in, and ran toward the hangar that housed this invention which was to startle the world. As he approached the hangar door at the side, something with the blouse of the Army uniform, the pants of the Navy, and a hat from the Marine corp, plus one Army springfield, stepped up to William and said in the sweetest voice in the world, "No oneth's allowed in there, thir."

"Ah, hooey," said Bill. "I'm the Department of Commerce all wrapped up in bear skin. I wanna see that invention."

"Oh, yeth thir. Sthraight ahead, thir," answered the Pan—, I mean gink.

Bill hesitated with his hand on the door. He wondered whether he should kill it or kiss it, but finally decided to do neither, and walked into the hangar. Some eight or ten people were staring at something on the ground, and as Bill walked up to join them he felt that his big moment had arrived.

"Where is it?" our hero asked as he pushed some of the crowd away to get a look at the world's greatest invention.

"Who are you?" said a palooka, as Bill edged his way into the crowd.

"I'm Barnacle Bill, the air sailor, and sometimes I work (he said under his breath), for the Department of Commerce.

"Duck, fellows, here's a Government man," said the palooka.

Crash, crash, crash! Gentle reader, this sound was glass, in plain words, bottles smashing up against the sides of the hangar. The aroma of moonshine, hard cider, stale beer, and several other unknown recipes filled the air of that hangar. At each crash, Bill grabbed his heart, or the place where it should have been, and as the aroma of the prewar cough syrup reached his nostrils, tears came to his eyes. Tears of regret, not sorrow. Many a "Sweet Adeline" and "Moonlight Bay" were wasted on that hangar wall before Bill finally stopped the massacre. Bill talked faster than he had ever talked before in explaining just what branch of the Government Service he worked for.

" . . . and I'm only a Department inspector, you dumb clucks, up here to see this invention, and I hope you have the compound jitters for that sinful waste. Don't you bimbos know that stuff you've been wasting is a darn fine hair wash."

Bill really meant this, as this was the only use alcohol was ever put to officially—external use.

There were loud wailings and gnashing of teeth when the hangar crowd finally realized Bill's position. A hunt was started for the man who had hollered the first warning but they would have had more success in finding the proverbial needle in a haystack.

The owner of the invention finally took Bill by the arm and led him to the center of the crowd, and there on the ground was the invention that he had dared death to see.

Gentle Reader, it was a mess of cans tied together with little props run by rubbers, placed here and there on the said mess of cans.

BILL took one look and because he was the Government man, turned and left the hangar immediately. If he had opened his mouth while in that

hangar the static from his words mixed with the vapors of the moonshine, would have spelled "Finis" for the hangar and its contents. On his way out he looked for the combined Army-Navy-Marine Corps, but this individual was no where to be seen. We might state that Bill was so disgusted with the world in general that his ship flew him back to the Oakland Airport minus the stabilizer and an aileron. This was his "steenth" hundred trip of the kind and for the "steenth" hundred time the ending was the same.

By this time, gentle reader, you probably think something should be done about all this. This may even sound like a waste of good gasoline and oil. Very true, but once in a million times (more or less) a good invention will pop up and the Department is always on the lookout for something that will help the flying game. Colonel Young, the Chief of the Department, has issued orders to each inspector to inspect every invention wherever possible, that has anything to do with aviation, and to help the inventor if the invention looks plausible. This help is advice as to the proper way to handle the invention.

The above is a parody on a true happening. It is not possible in this article to mention the names and places concerned, but incidents like this happen daily in most offices of the Department at large. Requests by the thousands come from unknown people who claim they have "the world's greatest invention." These are segregated into groups. Some look promising, others not so promising, and others—my modesty prevents a description.

If it were possible to mention names and places here the reader would understand why the inspectors rush to these inventions. Army officers, senators, and mayors, along with other influential people, usually endorse these letters to the Department. It is supposed that men of this calibre have some gray matter in their domes, but experiences as described above have led the department to believe that these endorsements are simply made as a matter of kindness to the inventor.

The inspectors of the Department are like prospectors, around the next turn is the big invention that will be a Godsend to the flying game. Yea bo, that's what they used to think, but after making trips to all points in the United States, most of the inspectors are ready to believe there ain't no Santa Claus.

These pests are classed along with flies. They are good for something, but like flies, the something is still to be found. They must be met and they must be gotten rid of. All this must be done in a nice, easy way. A private organization could take these pests by the seat of the breeches and toss them gently through the nearest door, but a Government agency, especially where

(*Continued on page* 191)

New Navy Hornet-Corsair Scouts Show Speed

Front view of the U. S. Navy Corsair, equipped with Hornet engine—The Navy still believes in biplanes.

HERE'S a view of one of the fourteen new Hornet-Corsair scouting planes which have been delivered at North Island, Cal., to Scouting Squadron No. 2, United States Navy.

They are twenty-three miles an hour faster than the ships they are replacing and constitute a formidable addition to the Navy's aerial armament. Their sturdy construction and speedy lines are apparent in this photograph. The Navy believes in biplanes.

Aqua-Gliding—The Wettest of Sports

Wading around in the refreshing cool water.

WELL, I have tried the thrilling sport of aqua-gliding, and I find it to be very exhilarating—in exactly the same way that a cold morning shower is exhilarating.

After several months of work on the pontoons, I had finally arranged to have a gentleman named Wilbur Wright (not, however, the famous pioneer flier) tow me with his Cris-Craft, reputed to do forty miles per hour.

I had had the usual difficulties in transporting the glider—not owning either trailer or a car with which to tow it—but at last everything was ready, and the big moment had arrived.

Our dream glider, the "Pride-of-Lakewood," was assembled on the shore of Lake Erie and eased into the water. I waded out beside it and climbed into the seat. The pontoons floated nicely and moved easily through the water.

Some boys in an outboard motor boat towed me out where the Cris-Craft waited. On the way out, I had several dark moments when the pontoons submerged completely. This was due to the fact that the thrust of the tow-line was above the drag center of the pontoons and formed a couple which forced the pontoons under.

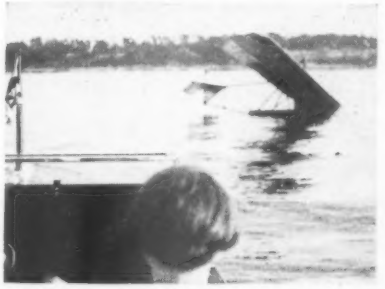
We overcame the trouble by slowing the outboard motor up, thus permitting the pontoons to rise, but before we had reached the Cris-Craft I had completely given up hope of taking-off that day. There was almost no wind, and the lake was so smooth that I realized that the surface tension between the water and the pontoons would be very great. I also knew that our aerofoil was very fast and this alone would make the take-off difficult.

But, what worried me most of all, was the diving of the pontoons. As I figure it, while undersea exploration may or may not be successfully accomplished in such ships as the "Nautilus," I am still of the opinion that a glider is not suited for the purpose.

The towing equipment consisted of about seven feet of shock cord, approximately 100 feet of rope and an iron ring. Oh, yes, and one fairly new motorboat.

When we finally got everything hooked up, I decided that the only possible way of overcoming the deep sea pontoons was to hold the stick back

(*Continued on page* 189)



One wing down—game's off.

Another Tough One on the Mechs

THIS incident happened in Kelly Field in 1923, and if two certain mechanics who were stationed there at that time happen to read this, they will no doubt remember it as the most uncomfortable afternoon they ever spent.

Lieut. X left his plane at one of the hangars with orders to have it given a general overhaul. Two mechanics set to work on it and in due time had it out front putting the finishing touches to the job. They had just started to put new cotter pins in the aileron hinges when they were called away.

Unfortunately, Lieut. X, who was in a hurry to use the plane, chose that time to come after it. Seeing the job apparently finished, he gave the ship a hurried examination, failing to see the lack of cotter pins in one aileron. He warmed her up and hopped off.

Well, Kelly Field has never seen two more sickly looking mechanics than those two when they came back and saw that the ship was gone. Visions of a crash, and then court martial when the crash was investigated, arose before them. But they kept their secret and had the whole company wondering about the abnormal interest they showed in each incoming plane.

The afternoon wore on and so did the two mechanics, growing sicker and sicker as they waited for news of the crash. Then, just as the gray hairs were beginning to sprout by the dozens, they saw Lieut. X coming in for a landing. He landed, taxied up to the line, jumped out and walked away. He had travelled nearly two hundred miles with nothing but the grace of God to keep those hinge pins from slipping out.

No sooner had the Lieut. disappeared from sight when two relieved mechanics, each grabbing a handful of cotter pins, made for that aileron with a speed that would have put a jackrabbit to shame.

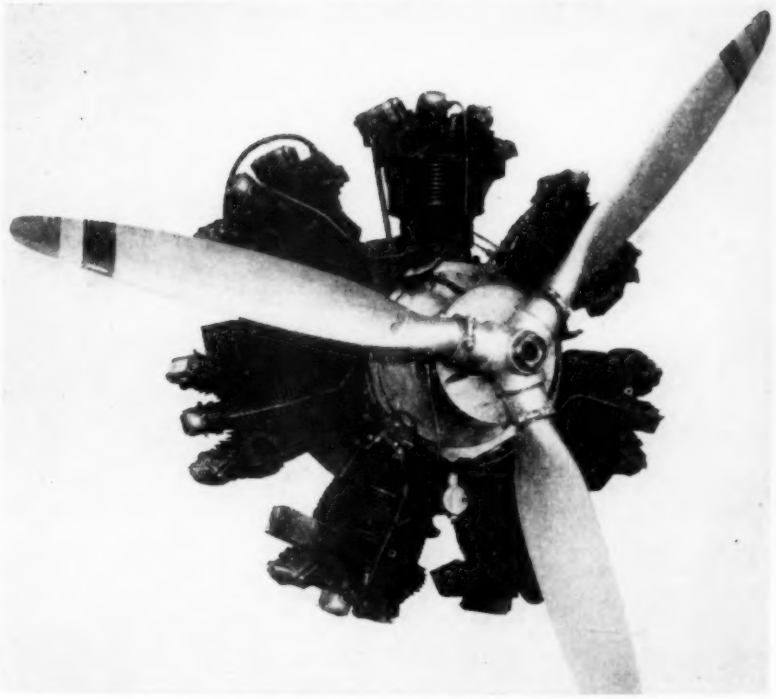
Lieut. X will never know how near he was to death that afternoon. Perhaps Lady Luck rode with him. But more probably he owes his life to the fact that he was a careful pilot. Had he indulged in any reckless stunting, as he came in over the field, the Army would have one less pilot today. Useless stunting has killed more than one good flier.

A Human Sandwich

WITH the ground coming up at him, and a plane hurtling down at him, Lieut. Neal Ausman dropped 2,000 feet at France Field, Canal Zone, before he took a chance and pulled his parachute cord.

At 6,000 feet Ausman jumped when his ship went into a spin, but he didn't dare open the 'chute because the plane was directly above him—falling at about the same speed. After his involuntary "free-fall" of 2,000, a friendly gust of wind saved his life by blowing him slightly to one side.

The Sutor Diesel Type Engine Shows Promise



Front elevation of the Sutor heavy oil burning Diesel type engine.

AN average saving of $1,000 a week, per plane, is claimed by sponsors of the new Diesel engine for the air. Great economies are expected because of the cheap fuel used and because the fire hazards also are greatly reduced.

This new engine was invented by John H. Sutor, a member of the committee appointed by the A. S. M. E. to standardize internal combustion engines. The inventor claims he has the first and only real aviation Diesel engine that uses cheap black oil of from 24 deg. Be. to 27 deg. Be. gravity as opposed to the 42 to 65 gravity oil required by other Diesels.

The Sutor engine oil is not inflammable, as are the lighter oils, and the writer saw burning paper thrown into it. The oil did not burn, nor was gas formed.

This Diesel does not smoke, produces no dirt and is quick to start and accelerate. There are few working parts. Moreover, it produces power without overheating. The inventor points out that the cheap oil can be obtained anywhere from two to three cents a gallon, while the higher grades are not always obtainable at any price.

Sutor's engine is of the solid injection type, developing 400 h.p. at 1,500 r.p.m. Fuel consumption is about .4 pound per h.p., or 20 h.p. hours per gallon. It is of radial type, with seven cylinders of 7-inch bore and stroke, operating on a 4-cycle basis.

Ignition depends entirely on the heat of compression. No hot coils nor other agencies are employed in starting. It operates under 450 pounds compression and starts readily when cold.

Pistons are aluminum alloy and running gear of vanadium alloy steel. Crankcase end plates are of steel alloy, the plates carrying two crankshaft main roller bearings. Steel construction was used because of the high Diesel pressure.

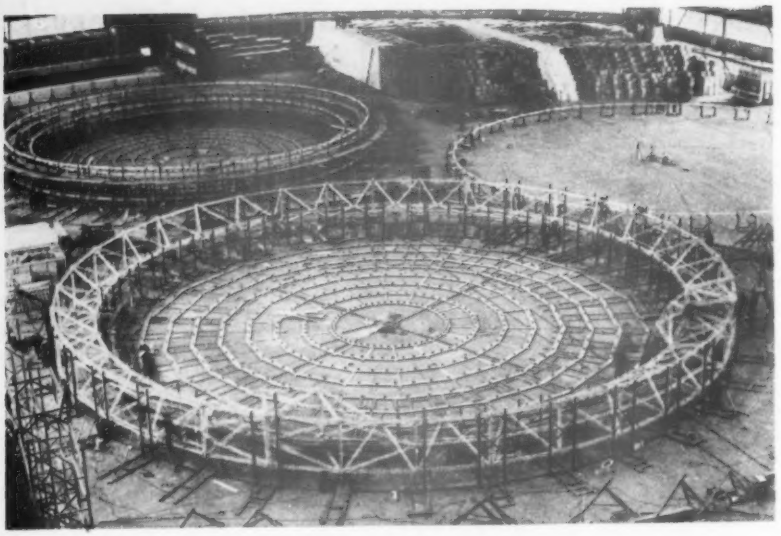
The cylinders are of alloy steel on which are screwed and shrunk the aluminum alloy cylinder heads. Inlet and exhaust valves are set at an angle in the cylinder head and the fuel nozzle is on the center line of the cylinder.

Fuel control and timing are very unusual and positive. The mechanisms are enclosed in the cam housing, with no exposed parts. Timing control is comparable to spark control on a gas motor. Mounted on the cam gear housing are the starter, tachometer drive, lubricating oil pump and fuel injection pump.

This fuel injection pump furnishes fuel under controllable pressure to a fuel header from which it is delivered to the cylinders. Between the pump and header are a strainer, fuel by-pass and accumulator, arranged to maintain uniform pressure on the nozzles.

The fuel nozzles are of packingless type, with needle valves lapped into nitroally bushings. It is registered into the cylinder head and has a metal-to-metal seat.

And Here We Have the Akron's Sister Ship



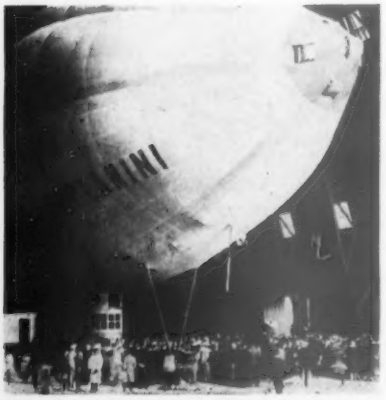
Transverse rings of the Akron's sister ship, ready for erection.

TAKE a look at one of the workmen in this picture and you'll get some idea of the size of the Akron's sister. These gigantic metal circles are parts of the frame for the new Navy dirigible, ZRS-5, sister ship of the Akron, as they appeared on the dock at Akron, Ohio. Work is progressing rapidly. The frame in the foreground was raised to signalize the beginning of the second stage of the construction program.

Needs No Landing Crew

THIS dirigible does not need a landing crew. Here is a dirigible that was designed by the late engineer, Forlanini, who died before he saw his dirigible completed. It is not a large craft, but has many interesting features.

It does not need a ground crew, depending on air jets that are supplied with air by the Isotta Fraschini motor. In practical use this idea would be of inestimable value to private owners, exploring parties and to armies transporting munitions from one place in the mountains to another.



This diribigle does away with a landing crew.

Revised Parachute Specifications

SEVERAL additions to the specification and material strength requirements for approved type parachutes have been made.

It is specified that fabric shall be free from gums, starches and foreign substances, and from imperfections that will lessen durability. Suspension lines are to consist of continuous cords, without splices or knots between connector links, and before being attached, the suspension lines are to be tested under 40 pounds tension.

Machine sewing is to be done with a shuttle or plain stitch and zigzag sewing with a 2-stitch zigzag sewing machine. The rip cord is to be designed to withstand a load of 300 pounds, and this requirement applies also to joints between the handle of the rip cord and the release which opens the parachute when the rip cord is pulled.

When these requirements are complied with satisfactorily, the parachute is dropped from altitudes varying from 500 feet to 2,500 feet, first with a 170-pound dummy, and then with a 600-pound lead weight. Finally it is tested under working conditions in a drop with a 170-pound man. The descent of the parachute is timed from the time of its opening until the ground is reached. The rate of descent, which shall not exceed 21 feet per second, is judged by the dropping of a 170-pound dummy man from an altitude of 2,500 feet.

Mr. Durant's Twelfth Ascension

A PHILADELPHIA magazine, published in 1834, contains an interesting article on the subject of a balloon ascension taking place on September 13, of that year. It also chronicles a parachute descent, but the jumper in this case was a rabbit—which is an appropriate animal for a jumper. Let's go on with the story as it appeared.

* * *

"Mr. Durant's twelfth ascension with his balloon was on the 13th of September. His voyage was most prosperous and happy.

"He rose with an easterly wind, but after passing half-way from Boston to Cambridgeport, came into a region where the wind blew strong from the west, which changed his course and brought him back over the city at a height of 8,000 feet. He then proceeded as far as Fort Independence.

"There he descended till he came within the influence of the east wind which brought him back over the city again.

"At first, he thought of descending on the Common, but he finally concluded to proceed as far westward as he could before night. Accordingly, he pursued his voyage successfully as far as Lincoln, 15 miles from Boston, where he alighted in safety and was kindly and hospitably received by the inhabitants.

"During this journey of nearly two hours, he must have covered thirty miles or more. He was several times so near the earth's surface that he could converse with the inhabitants, and in more than one instance, he threw them down papers.

"With his rabbit in the parachute, he was rather unfortunate. He sent it down a little east of the city, but instead of reaching the shore, as was expected, it fell into the bay."

* * *

Thus, we hear of bunny's tragic end, and it is just possible that bunny was one of our first parachute jumpers. This new item was copied and sent to us by Julia Graydon, Harrisburg, Pa.

Pilot Collides With Sparrow

TWO flyers were injured the same day at widely separated spots by accidents about as odd as any on the books. Jimmy Burns, mail pilot, had a mid-air collision with a sparrow over Birmingham, Ala.

The bird struck him in the eye, shattered his goggles and almost knocked him out. Burns managed to land, received treatment for a "black eye" and continued his flight to New Orleans.

At Long Beach, Cal., Mary B. Quinn, aviatrix with 400 hours of flying, has had two crackups and has come out of them without a scratch. When she went roller skating with friends, however, she went into a nose dive on the hardwood floor and broke two bones in her left ankle.

A Study in Airplane Engines

by LIEUT. HORACE S. MAZET

How we started out with a radial type engine and then came back to it after a period of 28 years

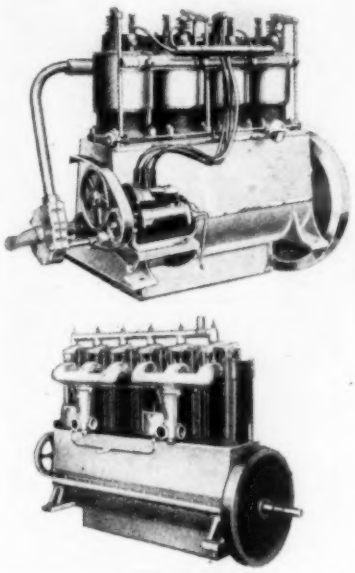
NO MATTER how important the airplane structure may be, we must not forget that it is the relatively small, and frequently concealed engine, that drives it. The engine provides the power for flight while the airplane itself may either be good or bad depending upon whether it utilizes the engine power efficiently or wastes it.

It was not until a powerful lightweight engine was constructed that human flight was possible at all. Many of the early airplane designs would have undoubtedly flown had they been supplied with a sufficiency of power from a reliable source. As a matter of fact, any object can be made to fly after a manner, if sufficient power is applied to it—even a brick or a barn door.

Up to the first successful flight of the Wright Brothers in 1903, many scientists were convinced that human flight was impossible. Later, came the realization that flight was as dependent upon the source of motive power or upon the weight of the power plant, as upon any particular arrangement of wings or lifting surfaces.

Then came the efforts of the engine designers toward the reduction of engine weight to the point where the engine was light enough to be practical in an airplane. Of these early designers Charles M. Manly was probably the most prominent. Manly, in 1902, produced a radial engine for the propulsion of Langley's "Aerodrome," which was the father, or even the grandfather, of the popular radial engine of today. Unfortunately the Langley airdrome was wrecked in the launching, but this does not conceal the fact that this early Manly radial engine was a successful type long before its time.

The Manly radial aviation engine, the grandfather of all radial aviation engines.—Built for Langley's "Aerodrome."



Above, The original Wright four-cylinder water-cooled engine. Below, A six-cylinder "In-Line" aviation engine.—From Henley's "Aviation Engines," by permission.

When the Wrights were convinced that heavier-than-air craft was a possibility, after their gliding experiments, they sought in vain for an engine that was at once strong enough and light enough to be installed on their biplane. As no such engine was marketed at that time, they were compelled to build it themselves, modelling it upon the four-cylinder vertical automobile engine common at that time. Four-vertical cylinders in-line, water-cooled, marked their first adventure in powerplant design.

Their first attempt at flight was made with a 12 h. p. engine, turning at 1,200 r.p.m. and having a dry weight of 170 pounds. This was approximately 14 pounds per horsepower, excessively heavy today, but far lighter than the automobile engine. The Wrights actually achieved flight with their second engine which had a rating of 35 h. p. and weighed only 180 pounds. It was also a four-cylinder, vertical water-cooled job.

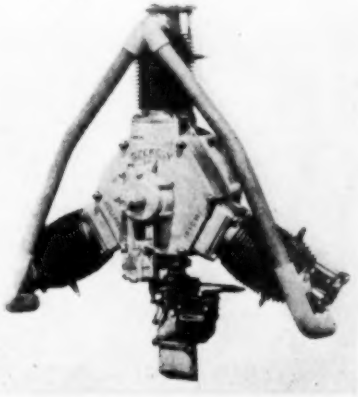
Model E-4 was the first Curtiss water-cooled engine, a 4-cylinder vertical rated at 50 h.p., running 1,500 r.p.m. and weighing 5 pounds per horsepower. After the efforts of Manly, Wright and Curtiss, improvements continued to be sought primarily in the field of weight reduction, but other factors such as reliability, direct operating economy, smoothness, compactness, ease of maintenance and ultimate overall economy, began to receive attention.

So now, in the last analysis, the airplane engine of today is the product of a vast combination of brains and individual efforts, each trying to settle the bothersome problems in turn as they came up. And, strangely enough, the outer form or shape of the successful air engines at present differ from those produced by the pioneers only in detail.

THERE is probably no factor in aircraft engine building which has received more undeserved attention than the cylinder arrangement. During twenty-eight years, from 1903 to 1931, first one cylinder grouping and then another became prominent among contemporary engines. This leaves us today with the same basic form that we had in 1903, the "in-line" or tandem cylinder arrangement of the Wrights and Curtiss, and radial or star shaped cylinder grouping of C. M. Manly, with some compromises between the two basic forms.

Indeed, if any definite tendency toward cylinder arrangement is apparent in all these years, it is a tendency toward compromising. The in-line, or tandem engine, is compact in width but not in length. It has, in general, less head resistance to impede the airplane's progress, but it affects adversely the maneuverability of the craft, besides involving clumsy and bulky installation.

The single row radial, on the contrary, is compact in length but its

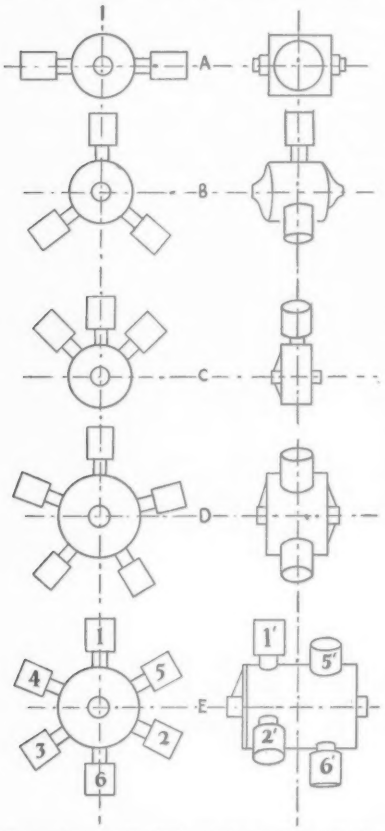


A typical three-cylinder air-cooled radial engine of a type commonly used for light planes.

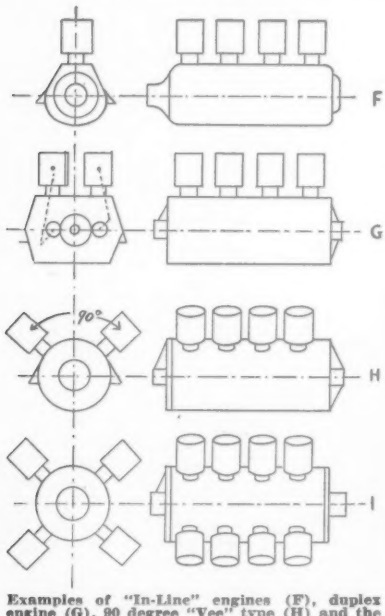
frontal area is much greater and thus tends to obscure the vision of the pilot in a very important direction as well as producing greater drag in spite of all the special cowling, sheet metal rings and other expensive and annoying devices which we have learned to attach to the engine.

So, in the natural course of time, the in-line engine developed into the familiar "V" type used in the Cadillac, Lincoln and other automobiles and also in many of our present day water-cooled aviation engines. Then into the "W" or broad-arrow type such as the Napier, Lorraine, Farman, Hispano and U. S. Army "W" type. Finally, came the "X" type which was originally used twenty years ago by Gobron-Brillé, ten years ago by Viking, now by Packard in a big racing engine and also by Irwin in the tiny Meteormotor.

While the tandem engine was developing into something quite different from its elemental and simple beginning, the single crankpin radial, one example of which is the well-known Whirlwind, seeking smaller diameter to cut head resistance, developed into the two-crankpin or two-row type. This is practically two radial engines, set one behind the other, and using the same crankshaft. At least one maker, Anzani with his 20 cylinder, has gone so far as a 4-row radial with five equally spaced cylinders in each row and all of the cylinders staggered with relation to the front row.



Examples of "Radial" engines. Two-cylinder "opposed" (A), three-cylinder radial (B), three-cylinder "Fan" (C), five-cylinder radial (D) and six-cylinder staggered radial at (E).



Examples of "In-Line" engines (F), duplex engine (G), 90 degree "Vee" type (H) and the "X" engine at (I).

MOST engines having radial cylinder arrangement, but not all, have been air-cooled. Notable exceptions are the Manly engine of 1902, the Salmson engine of wartimes and some of the Anzani models. Misconceptions of the fundamentals of the air-cooling problem have led most builders of multi-row radials to stagger the cylinders. Such engines are the Armstrong-Siddeley fourteen cylinder "Jaguar," the Lorraine-Dietrich fourteen cylinder model and numerous Anzanis.

Some of these builders, however, dared to put the cylinders of the second row directly behind those of the first row. Here we arrive at the complete combination of the radial and tandem ideas where the engine is just as much radial as it is tandem. Examples of these are the Salmson AB-18 and CM-18 with air-cooled Siamese cylinder heads, the Anzani twenty cylinder water-cooled job, the Curtiss "Chieftain," and others.

Most of these engines claim descent from the radial group, but the Curtiss "Chieftain" engine calls itself the "Hex" engine, apparently implying that it is a legitimate descendant of the inherent virtues of illustrious ancestors such as the "W," "V" and "X" ideas.

Unfortunately, however, in disposing of twelve cylinders in six rows of two each, it has come to a point where neither the use of push-rods nor overhead cam-shafts is really satisfactory, and where the usual methods of cooling can not be used advantageously.

After this rather extended discussion of cylinder arrangement, it is timely to repeat that emphasis on this feature is rather an unimportant factor in the trend of basic detailed design. Discussion of cylinder arrangement has this one advantage, however: it provides a simple and obvious method of classifying engines from their external appearance alone.

In the brief historical discussion which follows, therefore, we will refer consistently to cylinder arrangement—merely for clarity and convenience. We will, for the sake of simplicity, refer to the "in-line" cylinder types as "tandem," to the single-row and staggered multi-row radial engines as "radial" and to the "V," "W," "X," "Hex" and other radial tandem arrangements as "multiple tandem."

EVERYONE is more or less conversant with the famous Liberty engine made by the United States during the war. It is characteristic of the "V" type, such as the Packard, Rolls-Royce, Curtiss OX-5 and D-12, Hispano, Isotta, etc. These are descendants from the conventional automobile engines, and are the most prominent and persistent forms, along with the tandems, during the history of airplane engines.

Usually these engines have been water-cooled, although there have always been air-cooled models such as the early Renault and Fiat engines of about 1909 and so on down to the present crop of air-cooled Libertys, Allisons and Wrights. The current epidemic, which may become permanent, shows the smaller in-line jobs such as Cirrus, Gipsy, Pirate and a few hundred others—more or less.

The popularity of certain engines is traceable as much to chance as to any factor. From the beginning, cylinder

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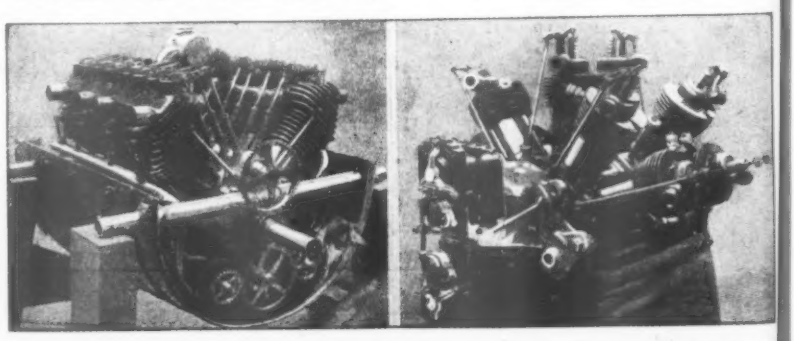


Left, an early Curtiss "Vee" type eight-cylinder air-cooled engine. Right, a "Fan" type air-cooled engine common in the early days. From Henley's "Aviation Engines by permission.

Start of the War Photo Fans' Club

WE have promised to start a War Plane Photo Collectors' Club for a long time, but for one reason or another this has been delayed up to this issue. And now here we go with the first few names of the collectors who have written in to us for entry. We hope that we will be able to add many more names to this list as we go on until finally we have a real club—full of pep and vim.

Now all you have to do is to write to each other about your favorite hobby. We list the names and addresses for that purpose. There is no doubt but what one reader has been longing for a photograph that some other fellow owns, and the second fellow may have something that the first one may have been looking for. By exchanging photos in this way you will be able to very considerably improve your own collection—and the other fellow's too. Here are the charter members:

WILLIAM PUGLISI, 195 Hawley St., Binghampton, N. Y., tells us that he has over 1,100 original photographs and prints of all sorts of planes. He will be glad to sell or trade, and can also tell you where you can buy more photos.

ERNESTO TABIO, 25 No. 445, Dedado, Habana, Cuba. Mr. Tabio is much interested in warplane photos and plans and sends us a picture of a Cuban Hawk. He does not state whether he has a collection started, but we assume that he has one.

E. B. HAWKINS, 1071, 83rd Ave., Edmonton, Alta., Canada, has an interesting collection of photographs taken on the western, Turkish and Russian fronts by a German pilot. We believe that he will sell copies of these photos.

HOMER R. HALE, 3820 Bellefontaine Ave., Kansas City, Mo., is collecting photographs of warplanes and also modern pursuit planes.

WM. EYEMANN, 609 Riley St., Atchison, Kansas, has a collection of photos from various countries of the world and is anxious to swap.

EUGENE FERRELL, 7418 Jeffery Ave., Chicago, Ill., wants to swap all kinds of photos.

FRANK BEILFUSS, 7127 Luella Ave., Chicago, Ill., is interested in swapping war plane photos.

Use Planes in March for Alaskan Gold

ALASKAN prospectors have taken to airplanes in their search for Alaskan gold. A. W. Johnson of Fairbanks has just returned from a year's stay in the gold fields, having been carried and brought out by airplane.

The improved method of transportation eliminates the weeks of toiling behind dog teams, allowing what was formerly a many days' journey to be made in a very few hours.

A Neat Looking Cabin Autogiro From England

This cabin Autogiro presents a pleasing appearance with its nearly rounded lines.

THIS is a picture of the new Camden autogiro, a product of the Cierva Autogiro Company. This has successfully met recent tests in England to prove that it can equal ordinary airplanes in speed, despite its formidable superstructure.

Although only two are visible in the photograph, the Camden autogiro has three rotor blades. These are of the cantilever type and without external wire supports. The Autogiro Company of America has asserted belief that the English model is a great advance in design of the autogiro type and that the three rotor blades operate better than the usual four.

Moreover, tests have proved that it has top and cruising speeds equal to those of conventional airplanes of equal horsepower.

The fuselage is narrow, having room for two persons seated tandem-fashion in the cabin. Streamlines are achieved mainly by a motor with cylinders "in-line" although air-cooled. There are small fins on the sides of the tail plane, and a third wheel beneath the motor cowling, makes take-offs easier.

Nearly Collides With Akron

THE Navy airship Akron has been called everything from "Mistress of the Heavens" to "Leviathan of the Skies," but it remained for an airmail pilot to call it a "menace to air traffic" —and with what he considers good reason.

Pilot Ray Fuller was flying the airmail between New Orleans and Atlanta. He ran his plane into a huge cloud bank near Mobile, Ala., when he suddenly saw the gray hulk of the Akron right there before him. The Akron at the time was on its Gulf coast flight.

Fuller punched the plane into a sharp wingover at 120 miles an hour and came out underneath the dirigible.

"It's my idea that the dirigible ought to be painted red," Fuller said, after he had landed in New Orleans. "I didn't think anybody would be up in that weather, and I was looking for airports—not airships."

Six Times Around the Earth

THERE are 150,000 miles of airways in the world, the United States Department of Commerce estimates. In the last three years the growth has been rapid, especially in Africa, Siberia and the Orient.

Builds Plane to Fly as Bird

ACCORDING to J. H. Montgomery of Los Angeles, he has studied the flight of birds for more than fifteen years, and at last has built a model airplane which flies on the same principle of upward thrust of wings. In a test, the model actually flew head-on into the wind, with no other power than that created by the adverse wind and the forward and upward thrust of wings. The photo shows John M. Walters, president of the International Power Co., which will build the plane, with the model of a bird in his hand, and a model of the plane on the floor, showing the similarity.

He imitates Bird flight.

Giant Wind Tunnel for Aeronautical Research

Showing Vertical Wind Tunnel during erection.

THE world's largest vertical wind tunnel, the only one of its kind in the U. S., is under construction at Akron, O. It is to further advance aeronautical research. The project, to be termed the Guggenheim Airship Research Institute, is being built by the Guggenheim Foundation, the City of Akron (through the University of Akron) and the California Institute of Technology. The tunnel is built in the shape of the letter "C", is of sheet steel, is 60 feet long and will have a powerful motor capable of creating a wind velocity of 125 per hour. The building costs $43,350 and the tunnel $15,000. The photo shows the giant tunnel before being lowered into the building.

A Ceiling Projector for the Navy

A CEILING light projector for measuring the height of cloud formations is being erected at the Naval Air Station, Hampton Roads, Va. There are only a few of these devices in the country and this is the first to be installed at one of the Naval Air Stations.

This new projector, of the latest design, has a light of 1,800,000 candlepower. The light, itself, will be erected on a hangar roof while the alidade and control switches will be operated from the aerological office.

To ascertain the cloud heights at night the projector will be flashed into the sky and the distance can be quickly determined by the measurement of angles.

Besides serving a primary purpose as a ceiling projector it is also planned to use the light as a beacon marker on special occasions.

Autogiro Turns Canard

THE unusual feat of an autogiro landing backward was unwittingly accomplished at the municipal airport in Buffalo, N. Y. Coming to earth in the teeth of a 45-mile gale, the autogiro found the wind too strong, and as it sank the last few feet before touching the runway, the wind was actually carrying it backward. Airport attaches grasped the wings and held the ship steady after it landed to prevent damage.

The First Air Duel

AT the beginning of the War, airplanes did not engage in air duels. They were used only for observation work. On the Eastern Front, Captain Nesterhoff observed the movements of the Austrian forces for the Russians from the air and Baron Rosenthal observed the Russians for the Austrians.

The captain and the baron were the only flyers in that section and it never entered the mind of either to attempt the dangerous task of interfering with each other while in the air. The only weapon carried by the two birdmen was an automatic pistol. In fact, the two were polite enemies. On the occasions when the two passed each other in the air, they waved greetings to one another.

One day, while over the Austrian lines, Captain Nesterhoff observed Baron Rosenthal in the act of taking-off for a reconnoiter over Russian territory. Being possessed of the daredevil spirit on this particular day, Nesterhoff decided to scare his polite foe into disaster. Unnoticed, the captain followed the baron.

When the baron was occupied observing a Russian position, the captain suddenly speeded up, intending to overtake the baron and bump the wing of the baron's ship, therewith causing the latter to become panicky and lose control of his machine.

When almost upon Rosenthal, Nesterhoff swerved sharply off, the left wing of his plane, striking the baron's right wing violently. The result was unexpected. The two wings interlocked and the next instant the two planes pulled each other around so that their propellers crashed squarely together. The pieces from both planes flew, and the next moment the wreckage of both machines was dropping earthward, and with it went the two luckless pilots to their death. This ill-timed collision has gone down in aviation war history as the first air duel.

Sign of the Times

WHAT is perhaps the largest airport sign in the world is that which marks Suffolk airport in Suffolk county, Long Island. The letters of its name are 85 feet high and 50 feet wide, and were made by filling in with white sand.

And the Flyers Go Boomp

FIFTEEN of America's leading aviators crashed in Washington, D. C., recently, but landed on springs, so none was hurt.

The fliers had been attending a banquet given by government aviation officials on the sixth floor of a Washington hotel. Afterward, they entered an elevator which proceeded to dive six stories.

It made a perfect 14-point landing on the basement shock absorbers; nobody was injured, and the fliers cheered. In the elevator were Ruth Nichols, Clarence D. Chamberlin, Rear Admiral William A. Moffett, Maj. Gen. James E. Fechet, retired, and other noted figures of the air.

60,000 Hours Without Accident

NINE pilots on British airways during 12 years of flying, day in and day out, have spent 59,900 air hours in flight and have not had a single serious accident.

Their judgment determines whether or not a passenger plane will take-off on schedule in bad weather. They are all adaptable, resourceful, skilled navigators and of sane judgment, and represent the type of passenger-plane pilot that is being developed in both the United States and the Old World under conditions of commercial flight.

Juice Control on Akron

IT doesn't seem like a very large switchboard, as two girls stand beside it, but it controls all the light and power aboard the Akron, the world's largest lighter-than-air craft.

Generators, motors, circuits to engine rooms, radio room, control room and all other equipment of the Akron are under "finger-tip control."

The switchboard, and all other electrical units, were specially designed for this ship and the three circuit-breakers at the top of the board are of vital importance.

The switchboard of the Akron, but not with the regular attendants.

White Flyers Who Lead Chinese Airmen

by SIEGFRIED F. LINDSTROM

An unusual story of the Chinese air forces and their soldier-of-fortune leaders

WILL white boys — experienced World War fliers, dare-devil soldiers of fortune, compose the backbone of China's Air Corps in event of war with Japan? Will the expert participation of these veterans, "just for the hell of it," mean a tower of strength for China, with ramifications that can startle the world?

These pertinent questions are being excitedly discussed by serious-minded Americans and Europeans over the bars of men's clubs in every city along the China Coast; yea, even by ladies over teacups; by men and women in drawing rooms, in hotel lobbies and everywhere that "two or three" *foreigners* are gathered. They are all buzzing with gossip in anticipation of possibly so astounding a turn of events; nevertheless, entirely within the realm of possibility.

At the same time, all eyes are focused as one—like that of a Cyclops—on a mild-mannered, unpretentious American, known in China as "General Chan," and with nine lives like a cat.

* * *

I CLOSE my eyes. Scattered all over China's vast terrain, well hidden from the enemy, I imagine I see aviation camps, landing fields, hangars—and all that goes with them. I see tremendous land armies, divided into multitudinous units, whose cannoneers perhaps are Russians—waging unending, deadly guerrilla warfare. For a time I see her forces shattered in every battle in which they engage; the entire Chinese coast is in the hands of the invader. But the scene changes. There are significant movements on the chess board. Then ——

White fliers already are in the service of both Nanking and Canton. Among them are some of the most noted aces of the late World War. In the process of uniting, history will repeat itself. The wily Cantonese will win out as usual. The resulting coalition government—formed from the union of Nanking and Canton—will witness the latter, the southerners, predominating.

Why, then, are Europeans and Americans resident in China at this moment, so excited about the Chinese Air Corps. Who ever heard of it, anyway? Answer: white lads already constitute its backbone. In addition, in event of conflict on a large scale, the far-sighted Cantonese are said to have evolved plans for a reorganization of their entire corps around this nucleus of white fliers; and their intention is to recruit as many others from the western world as will "throw their hat in the ring."

Bert Hall, white leader of the Oriental Air Fleet, in flight uniform.

History will repeat itself once more. Jolly, rollicking, soldiers of fortune, who do not know what fear means, reminding one of the immortal French Escadrille No. 124, of the World War, better known as "The Lafayette," will soar grey skies aloft again—but this time over fields far remote from France—over battlefields where once the hordes of Kublar Khan gave battle. Russians, Frenchmen, Germans, Italians, Americans—will be there; and what a battle they will offer—for the Sons of Han! "Prithee, what will be their motive?" the world may ask. "Fun, plain fun," will be the answer. "Fun—madcap adventure—'just for the hell of it'!"

Once China marches off for a real war with Japan, the leadership of her air forces undoubtedly will be entrusted to "General Chan," who is none other than Bert Hall, an American who hails from Bowling Green, Kentucky. Yes, Hall is a World War ace. Nine Germans were winged by his trusty machine gun during his service in France. To this dare-devil Yank, who is already 50 years old, and bearing military decorations from seven foreign governments, should fall the burden of commanding the "hard-boiled-est," "devil-may-care" swarm of "hell's angels" that ever got together. At the present time, he nominally is in command of the crack aviation forces of Canton. A Canton-controlled coalition government! A Canton-dominated Chinese air corps! Look for these!

BACK in 1913, when Turkey was warring on the Balkan states—Serbia, Montenegro and Bulgaria—Hall, together with a mechanic, were the *whole* Turkish Air Corps. After successfully straffing the Balkan Triple Alliance, he asked his Turkish employers for a little more pay. Refused, he flew over to his erstwhile enemies, who gladly agreed to pay more than he received from the "stingy" Turks. Thereafter, Turkey got the straffing.

Captured ultimately by the Turks, after a crash which was not on the program, Hall faced trial as a deserter—and a trial leading to a firing squad. The situation really was worse than one would believe, in hearing him tell today of his experience. Tight scrapes to Hall are seemingly part of his everyday life. They only *appear* to exhilarate him!

Ultimately, being an American, and flying only for the fun of it, of both of which facts the Turks took cognizance, he was pardoned and freed but ordered to leave the country. He did! France was his next point of call.

Nineteen-fourteen found Hall a resident of Paris. Together with other Americans, he joined up with the French Foreign Legion. At that time France had only eighty aircraft. In December, 1915, he and a few others managed to transfer to the aviation. Indeed, he was one of the first three Americans to do so. The Lafayette Escadrille came into being in April, 1916. From that time, until the transfer of its personnel to the American Expeditionary Army, in January,

1918, Bert Hall flew almost continuously for France.

After the war he married the daughter of a British admiral. He always is on the move! The world at large is his playground. If you cannot find him elsewhere, just peep into Paris.

Mixed up in motion picture distribution, which at that time was also my game, I first learned to know Bert Hall in Japan and China. We discovered we had a mutual friend, my own brother-in-law, who flew in America's famous 94th Pursuit Squadron, finally commanded by Eddie Rickenbacker. Two years ago we were both stopping at the American Club at Shanghai. Hall is a poor poker player; and as to recounting his strange deeds of adventure, he is reticence personified. However, we did discuss China from every angle conceivable; and long we debated as to what will happen—and when.

Fearless themselves and never flinching in the face of danger, the Japanese are as good soldiers as the world has ever seen. Give Japanese infantry a quarter of a chance—and as sure as the sunrise, which is their national emblem, comes out of the east—their hoarse cries of victory will rise over the battle's smoke. On the other hand, frankly, they make notoriously poor aviators—scientists describe this as being due to a faulty sense of balance, directly traceable to the fact that Japanese babies, often when asleep, are carried on their mothers' backs with heads dangling—and their air corps never has had any war experience whatsoever, s p l e n d i d organization though it admittedly is.

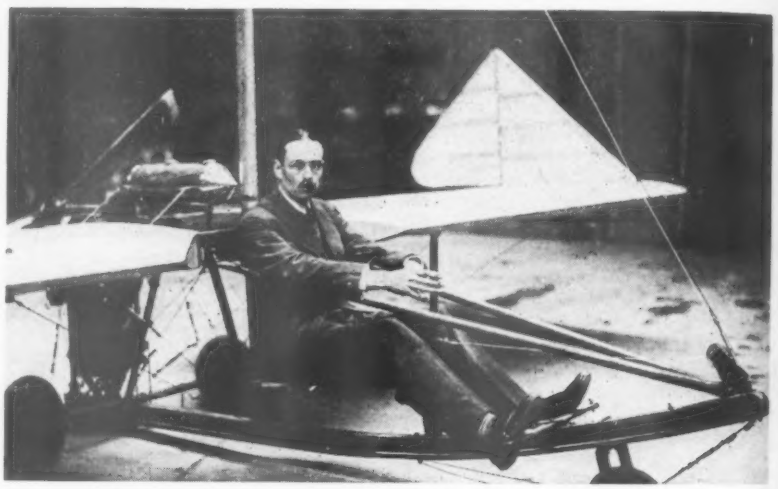
AT bombing a ragamuffin bunch of *hunghutzes* (Manchurian mounted bandits) they may be right in their elements; but, in combat flying against ex-World War aces, or against the highly-trained and skilled military aviations of any of the Western Nations, whose air training is infinitely more thorough than that of the Japanese, despite their fearlessness and willingness to learn, they may fare grievously and possibly be shot down like so many wild ducks.

Of the Napoleonic-Russian struggle of 1812, the historian, Sloane, wrote: "The nobility and burghers of both St. Petersberg and Moscow caught the war fever, opened their coffers, equipped a mighty army—and Russia was hopeful and eager for battle."

Chinese the world over are opening their purses and showering money on their fatherland—to fight what they call the "Dwarf Men." In the Philippines a volunteer army of expatriated Chinese is being drilled and equipped. Candidates for the Chinese Air Corps are being recruited in San Francisco and in northern Pacific coast cities. Chinese students at Harvard University are raising funds with which "to purchase 100 combat planes" and send home. Four undergraduates already have rushed homeward to en-

(*Continued on page* 192)

Uses Elevated Vane for Stabilizer



Close-up of the novel de Rouge self-stable ship, showing landing gear.

THE peculiar airplane illustrated above is the product of Vicomte Charles de Rouge of France. The inventor calls this odd looking plane the "ElectroPlan Sisma." M. de Rouge is an airplane designer of some note. He is continually looking for new and interesting improvements.

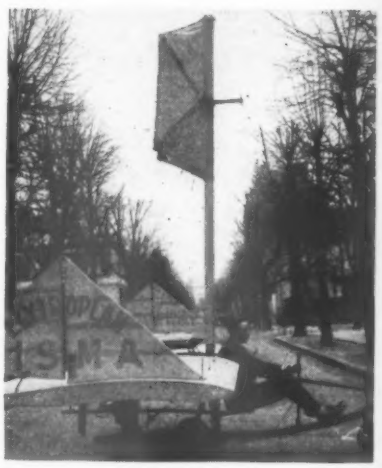
This interesting looking pusher-type plane is tailless. The usual vertical fins and rudders have been located on the tips of the wings. The main stabilizing surface is located on a high mast, several feet above the tops of the wings, the mast being held in place by a system of guy wires.

This kite-like stabilizing surface is opened or closed by the lever the M. de Rouge holds in his hands. The idea of this surface is prevent excessive banking around the longitudinal or "X" axis.

This elimination of inner side-slip on turns is a great improvement and advance in airplane design. However, this particular method of solving the problem is hardly suitable.

The resistance to the air-stream, caused by this sail surface, is so great as to interfere seriously with the speed of the plane, and thus greatly lowers its efficiency. Another undesirable feature of this plane is the lack of stability through the "Y" axis.

While this idea of M. de Rouge has the above undesirable features, it is



Showing the elevated stabilizing vane on the de Rouge ship.

another step in the eliminating of side-slipping in turns. It is hoped that he continues his work, having a little more success with each succeeding attempt, until at last he is able to design an airplane that will make turns with little or no bank.

Such an achievement will place M. de Rouge as one of the greatest designers of airplanes the world has ever known.

Oh, for the Wings of a Dove

THERE'LL be no more "doubles" for Miss Billie Dove, star of the silver-sheet, if directors heed her prayers and give her the air in pictures.

For Billie's a flyer, pilot's license 'n' all—and she expects a transport license soon. If there's flying to be done, Billie'll do it herself.

Good work, Miss Dove! We never *did* like the doubles.

Ship Sprays Mosquitoes

A CERTAIN type of mosquito, which carries the virus of yellow fever, has been getting free plane rides into the United States from South America.

Ships from the tropics, henceforth, will probably carry spray guns for killing the insects. The United States Public Health service, which has been investigating the matter, will be likely to issue the spray gun order soon.

What Our Readers Are Building

A department devoted to our readers' activities in airplane and glider construction.

WELL, well, the home-builders are certainly kicking in with the dope. The response is wonderful and the quality of the correspondence is 'way above par. In fact, I believe that it would take about four pages to show everything that we have received this month, but we're not going to run it all this time. No sir. Next month might be a lean month and then we would be sorry that we shot it all this time.

One thing that pleases us most, are the two words used by a number of our contributers. They call this department, "our column," and that's just what it is, fellows—it's your column.

We have been told of so many Ford and Chevvy conversions that we are wondering whether there will be enough engines left to drive the cars. The old Ford Economy Club has shown us a lot on the subject of cost reduction, but one contrib capped the climax when he told us he got off the ground with a power plant costing $22.50. Of this amount 50 cents went for the original Ford engine block.

Now. Come in with those stories and we'll have a rip-snorter next month. We'll pack the photos in so thick that you'll think this is a page of war-plane photographs, just like our album. As we have remarked twice before, this is *your column*, and it's up to you to support it with all sorts of dope on lightplanes and gliders. We can't run it without you, and your contributions.

Now about writing that story. You don't have to write it in finished style to make the grade. Just note the main features as simply as you wish, and never mind how it sounds. We wish the dope and a good photograph. We'll do the writing part here in the office for you if you wish. Photographs tell the story and we can't very well do without them. However, an ordinary snapshot will be all that is necessary, if it is clear. In fact, the pictures you see on this page, with the exception of one, are all taken from snapshots.

Attaboy. Send 'em in. You want to look at the other fellows' ship and he wants to give yours the once-over. You tell 'em.

And Now We Have a Chevvy Job

NOT contented with staying on the ground, Harold Burd, 5755 Grove Ave., Chicago, Ill., has just finished a 31-foot span monoplane, driven by a Chevrolet engine. He promises a photo of the job in the near future, which we promise to print as soon as it is received.

Flying Printer Is Successful Lightplane Builder

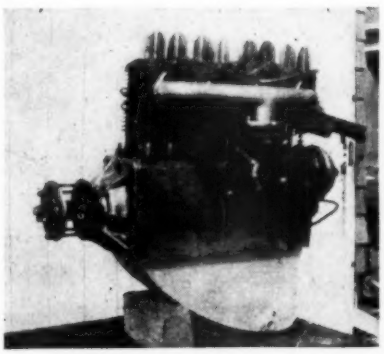
Showing the Terle Flivver surrounded by admiring friends.

JOSEPH TERLE, job printer, is shown seated in the cockpit of his home-made airplane, a back-yard masterpiece that cost him ten years of labor and heavy thinking. But Joe is getting his reward.

The photograph was taken at Roosevelt Field, L. I., and standing beside the plane is Andy Enslow, veteran pilot, complimenting him on the ship after a series of tests.

Bert Acosta, famous transatlantic flyer, also took Terle's plane aloft and reported himself pleased with it. Efforts are being made toward commercial production of the printer's pride.

And Now—Converted Henderson



The Henderson Engine showing new oil pan and prop mounting.

WILLIAM SHEEHAN, Walpole, Mass., together with three of his friends, built a Heath Parasol and converted a Henderson motorcycle engine to power it. The converted Henderson engine is shown herewith.

By the donations of a friend, they were enabled to get the services of a test pilot to fly the ship, and those of you who have tried to finance the employment of a test pilot know just how much assistance this donation was. After the test, its performance was proclaimed as being just as good as that of an "OX" engined trainer.

P. A. Again Does Its Stuff

WE HAVE a very nice letter from J. S. Gregory, proprietor of the East Port Garage, Eastport, Mich., who sends us a picture of the fuselage he is building, just before the framework was covered. He says in his letter:

"OUR PAGE is a great idea on your part, and I for one, hope you can get enough material to keep it going. It should be a great help to all the fans. I have learned all I know about aviation from your magazine. Try to run something about setting up a plane, if you can."

This is just exactly what we intend to do, and if this advice comes from some of the readers of this column who have successfully flown their ships, just so much the better.

Well, it used to be difficult to build a wood fuselage at home, but to build a steel type requires still more labor and trouble. Our best wishes for the job.

Fuselage built by U. S. Gregory of Eastport, Mich. A nice job.

Business Men Do a Little Gliding

Miller in the Muskogee glider.

IT IS interesting to know that business and professional men are now getting into the glider game. A glider club of business men, formed in Muskogee, Okla., have just completed the building of their own glider, which they estimate, cost them less than $100.

The picture, sent to us by G. Kenneth Miller, of Tulsa, Okla., shows Q. B. Boydston, president of the club seated in the glider. He is receiving valuable instructions, so it seems, from Frank Nation, who had charge of the construction of the glider.

Model "A" Fords Are Just Too Good!

The "A" Ford lightplane.

IF anybody has a failure to report, after equipping a plane with the Model "A" Ford engine, we'd like to hear about it. So many report success that it's monotonous.

A lightplane was recently completed by B. J. Trammell, W. B. Stafford and H. E. Bishop, of McCullough Heights, Greenville, S. C. They powered it with the Ford motor, changing only the cooling, oiling and ignition systems. Yeah, it's a success!

Just a Little Hint to the Wise

HERE is some news from Wilbur Robinson, Rock Island, Ill. Wilbur built himself a fine little ship, but soon ran up against that obstacle that so many lightplane builders encounter—he was still lacking a power-plant.

However, this was nothing at all to friend Robinson, for he dug up a Ford cylinder block for half-a-buck and started in to get some action. By scouting around, he picked up the pistons, connecting-rods, and so-forth, until he had all of the parts that enter into an engine, and at a very reasonable price. After the assembly he tested it, and thereupon rests a tale.

While making the test, he learned a lesson that he wants to pass on to the rest of the bunch. The subject of the lesson is: "Bolt down the engine firmly so that prop cannot drag it loose."

After assembly, he set up the engine for test, somewhat carelessly, and then let her percolate to the tune of about 1450 r.p.m. After a minute or so, the prop pulled the engine loose from the stand and started on a little hop of its own. The net result was one busted prop and a slightly damaged engine. No damage was done to Wilbur, but if he had been standing six inches nearer to the engine, it would have been just too bad for Wilbur.

And now we are going to add another hint. See that the prop is properly bolted and safetied to the shaft. We have seen a number of props fly off, and believe me, there is plenty of kick in them when they fly.

Learning to Fly by Night

A SPECIAL course in night flying lately added to the comprehensive training schemes supplied by Britain's "air university" at Hamble, is another indication of the modern trend towards scientific aviation.

Pilots who wish to take the course, must have flown at least 95 hours "solo." They are instructed in dusk landings, night landings with the help of ground flares, and night landings with only the light given by flares carried at the wing-tips.

After a period of "dual" tuition, with the instructor in the other cockpit, the pupil goes through all these maneuvers by himself and in addition he has to make a cross-country flight in the darkness.

Soldier-Engineer Is Now a Lightplaner

John Frokop's ship.

JOHN FROKOP, an army engineer at Fort Dupont, Dela., sends a picture and a short description of the lightplane he has constructed in the barracks. It is quite a sporty looking little monoplane, powered with an ACE motorcycle engine that revs up to 3,000 r.p.m.

It is a single place ship which, appropriate to its size, is called the "Half-Pint." We are all anxious to hear more about its construction and performance, so J. F., come across with some more news.

Radio Guided Bomber

By J. M. H. Hawley

(See Cover)

IN 1918 the "Big Bertha" was the greatest menace. In 19?? airplanes will be the great menace. Airplanes with robot flyers. Airplanes controlled from miles back of the lines. Airplanes that will carry more death and destruction than five "Big Berthas" firing together.

Fantastic? Not a bit of it. On the Great American Desert a few years ago tests were made with small planes carrying charges of explosive against dummy targets. The crude methods that were used then gave conclusive proof that an aerial bomb, an airplane with explosives in it, could be sent against distant targets, with high accuracy.

At some distance back of the lines, and in an isolated territory, will be a small radio shack and some hangars and a bomb dump will be at a safe distance. Instead of a group of pilots, there will be a few technicians and a radio man. The planes lined up will not be in the pink of condition. They will be old planes that are considered unsafe to use.

Instead of pilots, they will have robots. There will be no machine guns to shoot down enemy airplanes, but in their place there will be many pounds of high explosives. Radio equipment will take the place of the brains of the pilot. When the plane is gassed up and ready, the radio man in the shack will take charge. Very likely a catapult will be used to start the plane on its trip of destruction, to be sure that it is started safely.

As soon as the plane is on its way, the robot and the radio man control its flight. Think of it: a mechanical man controlling the flying and a man many miles in the rear controlling the direction. Not only that, but the plane will be talking to the radio man all the time. A continual humming noise in the ear phones of the radio man will tell him just where the plane is and what it is doing.

There will be no danger of a premature explosion if the plane should fall before it got over the enemy lines. Small propellers are connected to the fuse cans. As they revolve they screw the caps down till they contact with the detonators. These screws are so set that the plane will have to fly into enemy territory before the contact is made. Our own men in the trenches will not be endangered.

Finally, the radio tells the operator that the ship is on its target. A control is pressed by the operator, exploding small charges of dynamite and the wings of the plane fall off. The rest of the plane, with the motor still roaring, turns and dives at the target with incredible speed. Smash! and it hits the target. A moment of delay till the target is penetrated and a gigantic ex-

(*Continued on page* 185)

Plans of a Wartime Breguet Bomber

by JOHN B. NORTRUP

Here we have the full size plans and photo of one of the best bombing planes in the French service during the World War. It was a metal ship that was technically far in advance of its time.

Side elevation of Breguet Biplane, a neat looking ship.

IT IS strange that certain of the many types of bombers and fighting planes employed successfully, and in large numbers during the World War, have remained in comparative obscurity so far as the general public is concerned.

Among these machines is the efficient and effective Breguet Day Bomber that rendered such excellent service, and yet whose reputation has been submerged by a deluge of Nieuports, Spads, D. H.s, Camels, Snipes and other types popular with the fiction writers.

Now, the Breguet was built by one of the oldest airplane constructors in the world, The Societé des Ateliers d'Aviation Louis Breguet, and is one of the first metal ships to be produced. Louis Breguet, a prominent French electrical engineer, had been experimenting with all metal construction ever since 1909, and his efforts were concentrated in the type B-14, which is the subject of this article.

Model B-14 is a two-seater day bomber, fitted with a 12 cylinder, 300 h.p. Renault engine. Toward the end of the war it was succeeded by the B-17 with a 400 h.p. engine of the same make. Both are single screw tractor biplanes of very distinctive appearance, the hood greatly resembling an automobile hood, while a short stub of an exhaust pipe projects over the upper wing.

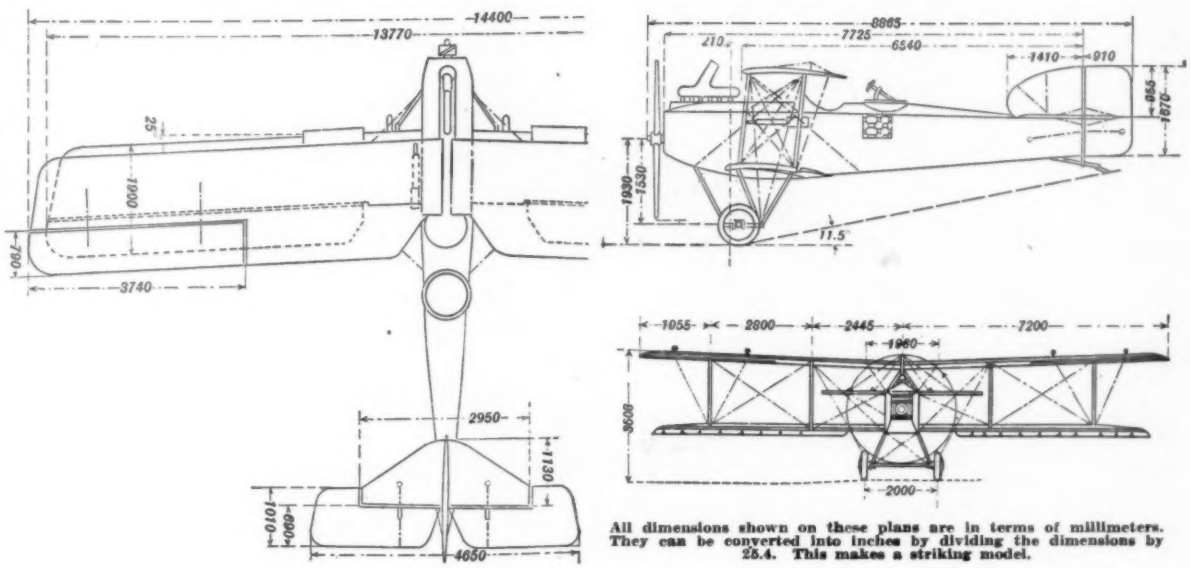
It will be seen that the wings have a strong dihedral angle and are swept back. Strange to say, the stagger of the wings is negative with the leading edge of the lower wing projecting forward of the top wing. This was adopted in only a few war-time ships, but it proved effective.

Now, in respect to the wing construction, the wing spars were of duralumin tube of rectangular section, strengthened at the strut connections by plugs of ash. Duralumin tube bracing was used inside the wing at all points, while the box ribs at the struts were also of this metal. Wooden intermediate ribs are employed.

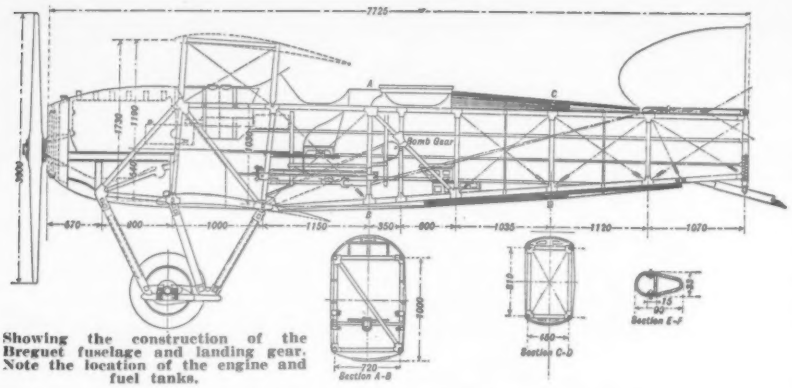
Ailerons were provided only on the top wing, hinged to the rear spar, but on the lower wing were the typical Breguet "equalizer flaps," that looked like ailerons but which performed an entirely different service.

The equalizer flaps are hinged to the rear spar of the lower wing like the ailerons, but instead of being connected with the control stick, are maintained at a given angle by rubber cords. This permits the equalizer flaps to vary with the wind pressure, and they are therefore automatic adjustments for camber, just like the flexible trailing edge of the Caudron ships.

Experience showed that the equalizers had a very material effect upon the flying qualities of the Breguet bombers—the most successful bombers in the French service. There is no doubt but what the equalizers improved



All dimensions shown on these plans are in terms of millimeters. They can be converted into inches by dividing the dimensions by 25.4. This makes a striking model.



Showing the construction of the Breguet fuselage and landing gear. Note the location of the engine and fuel tanks.

the speed-range and gave the ship a steady "gun platform" in gusty weather.

A sudden gust striking one of the flaps would raise it slightly, and reduce the lift on that side so that the ship would not rock about its axis. For the benefit of the model builders, the wings were covered with a bright yellow fabric, distinctive of this ship.

The interplane struts and, in fact, all of the exterior bracing aside from the stay wires was duralumin tubing. Connections were either of duralumin or steel stampings.

And now we come to the metal fuselage, which was built up almost entirely from duralumin tubing, riveted together through welded steel tubing. Tension is taken up by the conventional cross-wire bracing. At the rear the fuselage is covered with canvas, while the covering of the engine compartment is aluminum.

At the top and bottom of the fuselage the covering is rounded off by fairings, but history does not state whether these fairings were metal or wood. As indicated by the sections, the sides of the fuselage were deep and flat. This probably accounts for the remarkable stability displayed on sharp turns.

The water-cooled Renault engines drove the propeller directly, a remarkable fact when we consider that Louis Breguet was a firm believer in geared-down drive from the time of his earliest experiments. The aluminum radiator is located in the front of the nose, and is divided into two independent sections, one section for each bank of six cylinders.

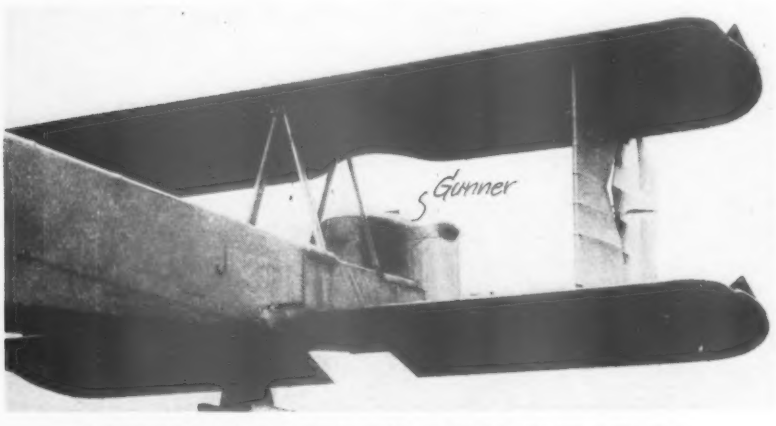
For the benefit of those who wish to convert the metric dimensions into the foot and inch system, we will give the conversion factors. One inch is equal to 25.4 millimeters.

This Gunner is Located on the Tail

GUNNERS have been located, as a rule, in the cockpit behind the pilot. This gives him a considerable zone of fire, about 270 degrees in most cases, which is perfectly permissable with a monoplane or single surface tail. He can fire over such a tail without hindrance.

Now, when we get up to the very large size bombers of modern times, we run up against the problem of the biplane tail that is nessary with these big machines, which seriously obstructs the rear fire zone.

And so, to insure a clear rear zone, the builders of this English bomber have located the gunner's turret on the biplane tail. This tail is so large that it looks like a biplane wing—but it is not.



The gunner on this bomber is located in a turret on the tail of the ship.

History of Balloon Busting in the World War

ALTHOUGH the exploits of the "balloon busters" of both the Allied and German armies formed one of the most eventful chapters of the World War, and the operations of these intrepid fliers wrecked havoc on the so-called "eyes of the armies," it was not until the close of the conflict that extraordinary steps were taken by the American balloon corps to combat them.

The destruction of observation balloons was developed into a specialty by aviators of both sides, and with the burning of a balloon, a unit was usually put out of commission for hours at a time. Most American balloon companies were ordinarily equipped with an extra balloon which was carried deflated, but it was a practical impossibility to have sufficient hydrogen gas on hand for immediate use to inflate the balloon and begin operations within a reasonable time.

The ordinary means of combating air attacks on balloons, was anti-aircraft artillery and tripod-mounted machine guns. It was a rare occasion for either of these to prove effective, although occasionally it was possible to repel the hostile craft before the balloon was set fire. Aircraft would frequently follow the balloon down to within a few hundred meters of the earth while they peppered it with incendiary machine gun bullets.

Not only were the lives of the observers greatly endangered by these attacks, but the material loss by the destruction of the balloon was enormous. Once the balloon was destroyed, it was necessary to haul hydrogen gas drums from the base—far in the rear—before the reserve balloon could be inflated and made ready for use.

IN August, 1918, attacks by German aircraft had become so numerous that officers began consideration of a plan to either terminate or curtail the menace. This plan was to inflate a condemned balloon with a mixture of oxygen and hydrogen gas in such proportions as to produce an explosion when incendiary bullets were fired into it.

Frequently the hostile fliers did not fire on the balloons until they were within 50 meters, and it was believed that the explosion of such a gas-filled balloon would be sufficient to throw the plane out of control, even if within 100 meters of the balloon. To make the decoy as realistic as possible, a basket parachute was attached to it and released from the ground.

The decoy was to be placed at a high altitude in the region of an active balloon, which would thus draw the attack of the enemy craft. In the event that the explosion of the balloon did not destroy the attacking craft, it was believed the effect on the

(*Continued on page* 184)

Question and Answer Department

THIS department is always glad to answer questions on the general subject of aviation so long as the questions are of interest to our other readers. We will publish all the queries together with their answers, so far as the space permits, but we have so much correspondence along this line that it is impossible to print all of them in the issue following the date of the letters. Have patience if your letter is not published immediately. They are all printed, one by one, in the order in which they are received.

This department is open to all of our readers and we welcome your inquiries so long as they apply strictly to aviation. So send in your questions. This service is free to everyone, but please avoid personal matters or subjects that are not of general interest. And just as a particular favor to the editor, please *print* your name and address so that no mistake will be made in sending a reply. Every month we receive letters very indistinctly written, and sometimes the writer has omitted his name or address altogether.

* * *

QUESTION:—John J. Kranz, Grand Rapids, Mich. *Do you believe that tailless ships are practical for small lightplanes, or is there a disadvantage to their use? While it is just possible that they can be flown experimentally, yet I cannot help but feel that they cannot be made as controllable as ships having a big tail group located behind the wings.*

Answer:—SO little real investigation has been made into the performance of tailless ships that it is difficult to give a positive answer to your letter. While the tailless ship is nothing new in principle, yet very little is known about the performance from a technical standpoint.

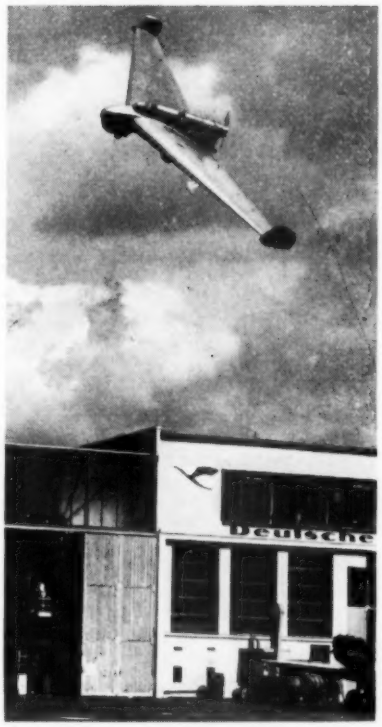
However, so far as I can see at present, there should be no trouble in flight if the control surfaces are properly proportioned. Their leverage about the span of the wing in flight should be just as effective as when placed behind the ship. However, the surfaces of the tailless ship should be larger as they are out of the propeller slip stream, and further, they are practically ineffective when taxying on the ground for the same reason.

* * *

QUESTION:—Ralph P. Thrimble, Denver, Colo. *I have heard naval flyers say that once in a while they meet with a condition where the wind is always on their tail, no matter what direction they may be flying in. Just how can this be unless the wind is blowing from all directions at once?*

Answer:—THIS is an old navy joke, but it is true in one exceptional case. When you are flying around a water-spout, the wind is always on the tail of the ship if you are flying in the direction of the wind. That this is true will be easily seen from the accompanying diagram.

All questions of general interest on any phase of aviation will be answered authoritatively by Popular Aviation's Technical Staff.



Tailless airplane banking on turn.

* * *

QUESTION:—K. L. Sullivan, New Rochelle, N. Y. *How can a balloon pilot control the flight of his balloon, making it rise and descend at will? I have also heard that the balloonist can travel in almost any direction that he wishes, regardless of the direction of the wind. Without power to fly against the wind, I do not see how this is possible.*

Answer:—A BALLOON is made to ascend by reducing its weight, that is, by throwing out a small amount of sand or water ballast. To descend, a proportionate amount of gas is allowed to escape, thus reducing the lift. This is accomplished by "valving" or by momentarily opening a small valve in the top of the balloon envelope.

A balloon must float along with the wind if it is not supplied with power, but very often a balloon can be maneuvered so that it will float along in the desired direction by going up higher or lower until a wind is found that is blowing in the desired direction. The wind direction varies considerably at different altitudes, and frequently a wind will be found blowing at high altitudes that is directly opposite to the surface wind.

* * *

QUESTION:—Chas. W. Purdy, Roanoke, Va. *How much power is required to lift an airplane* 5,000 *feet, the weight of the ship being* 2,000 *pounds? How do you get this into terms of horsepower?*

Answer:—YOU have omitted an important bit of data in your letter—you have not told us how much time is allowed for climbing the 5,000 feet, or in other words, have not given us the rate of climb. We can easily calculate the total amount of work expended in lifting the weight, but work is a different thing than power. Work does not take time into consideration but simply sums up the energy expended. Power is the rate of doing work.

The total work done is equal to the height in feet multiplied by the weight, or in this case, $5{,}000 \times 2{,}000 = 10{,}000{,}000$ foot-pounds. This cannot be converted into the dimensions of horsepower.

Let us say, for example, that this energy has been expended in 1 hour, 40 minutes—or in 100 minutes. Therefore, the rate of work or power is $10{,}000{,}000/100 = 100{,}000$ foot-pounds per minute. Since one horsepower is work done at the rate of 33,000 foot-pounds per minute, the theoretical power is 3.33 h.p.—no losses considered.

Now let us say that the ship climbs the 5,000 feet in 10 minutes. The power taken for climbing alone is ten times as great or 33.3 h.p. It should be noted that the actual power taken to lift the ship at either rate of climb is only one part of the total power demand, for additional power is required for propelling the ship forward at the same time.

* * *

QUESTION:—James W. Walker, Tulsa, Okla. *I have heard that some aeronautic engines are provided with four valves. How do these valves work and what is the final improvement due to the use of the four valves?*

Answer:—THE power output of any cylinder is proportional to the weight of the gasoline-air mixture taken in at each stroke. Therefore, the resistance to the flow of the incoming mixture is cut so that the flow will be as rapid as possible, filling the cylinder in the very brief time that the valves stay open. To assist in this flow, the flow area of the valves is increased to the greatest possible amount.

Now, we can use two very large valves, one inlet and one exhaust, but

this has several disadvantages. In the first place there is not room enough in the cylinder-head to increase the diameter to the required degree. Second, such large valves are very heavy, pound on the seats, warp out of shape and cause much wear on the camshaft.

It is therefore better to use four valves. Two inlets and two exhausts. A greater percentage of the cylinder-head area can be utilized with four than with two valves and a greater flow area is provided. Second, the valves are lighter and do not cause so much wear or other trouble. The two inlet valves open and close together as do the two exhaust valves.

There is some improvement in the performance, but not as much as would be imagined with all this extra area. The mixture flows into the cylinder more freely, and the exhaust gases exit without as much back-pressure, but the net gain is only a few per cent in the average case. However, with racing engines, it is the last two or three per cent that wins the race so that this is one reason why multiple valves are used on engines.

* * *

QUESTION:—Joseph J. Freund, Mont Claire, N. J. *What is the difference between the angle of incidence and the angle of attack? Then, what is the "riggers angle"? I assume that these angles apply to the wings.*

Answer:—THE angle of attack is the angle made with the wind stream by the chord of the wing. It is this angle that is concerned in the lifting effect of the wing. The angle of incidence and the "rigger's angle" are the same thing. This is the angle of the wing chord with the centerline of the ship or with some other fixed point on the ship, and is therefore a constant quantity.

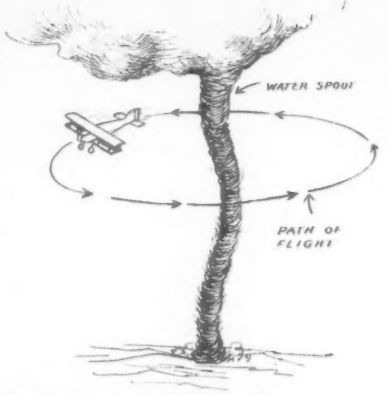
* * *

QUESTION:—Fred L. Jessup, Easton, Pa. *I have heard that there is a method of calculating the power taken for flying a ship when the speed of the ship and the propeller thrust are known. Can you give this rule in a simple fashion?*

Answer:—THIS can be computed by a simple rule that is easy to remember. Multiply the speed of the ship in miles per hour by the propeller thrust in pounds. Divide this product by 375 and the result is the horsepower required for driving the ship. It should be noted that this is not the engine horsepower, for the engine must deliver from 30 to 40 per cent more horsepower to make up for losses in the propeller, etc.

* * *

QUESTION:—Harry Camp, Phoenix, Ariz. *I have read about variable camber wings and slotted wings giving a greater speed range than the plain type wing. The idea, as I see it, is to make the wings more efficient at low speeds than at high, the lift being increased at low speed and destroyed at high speed. If this is the case, then why can't a flap be used on the back of the wing that will destroy the lift at high speed when it is raised up? The wing area in this case, would of course, be designed to take care of low speed conditions.*



Airplane is shown flying around a waterspout in direction of wind.

Answer:—THE great trouble with an arrangement of this sort would be that it would so greatly increase the drag at high speed that it would call for too much gasoline and power. Of course, if this arrangement could be made so that it would not stir up the wind-stream too much it might be possible—but not with a breaker strip.

* * *

QUESTION:—K. B. Bonick, Ashtabula, O. *I read in my physics manual that all bodies fall at the same speed in a vacuum, hence if there were no atmosphere on earth would a parachute fall as fast as a rock and be useless?*

Answer:—ABSOLUTELY. The effectiveness of a parachute depends upon the great area of resistance that it presents to the atmosphere. But if there is no atmosphere, the parachute, a ton of rock, a chunk of iron or a bushel of feathers would all fall together at the same rate.

* * *

QUESTION:—L. L. Cosgrove, Michigan City, Ind. *Is pure aluminum used for airplane parts or is the aluminum treated in some way to make it stronger? I have found pure aluminum to be quite soft and weak in other branches of industry.*

Answer:—PURE aluminum is too weak and uncertain to be trusted for any structural members carrying an important load. Further, pure aluminum is difficult to machine. Where aluminum is used in aircraft it is alloyed with some other metal such as zinc, copper, magnesium, etc. The alloys, Duralumin, Bohnalite, etc., are combinations of aluminum with other metals, the alloying metals conferring new properties upon the aluminum. Some of the alloys can be heat treated, forged and hardened which is not the case with pure aluminum.

QUESTION:—Thomas E. Rothacker, Springfield, Mass. *I have heard that there is some special precaution that must be taken in handling cold-drawn steel but I have forgotten what it is. Will you please tell me some of the peculiarities of this steel?*

Answer:—THE strength of cold-drawn steel resides in its hard dense outer skin, the interior of a bar or sheet being quite soft. Therefore, we must be careful not to injure the outer surface by deep scratches or overheating. Again, if we remove the hard skin on one side of a cold rolled sheet or bar, it will curl up or warp out of shape because the skin tension is stronger on the perfect side than on the injured surface.

* * *

QUESTION:—S. D. Frought, Muskogee, Okla. *Why don't flat surfaces work as well as the so-called cambered or birdlike wing sections? They would be cheaper to make and much stronger because deep spars could be used across their entire width. Are they very inefficient or have they been neglected just because no one has thought of using the flat surfaces?*

Answer:—FLAT surfaces, even when very thin, create a great relative drag or resistance when used as main lifting surfaces. They stir up a tremendous turbulence or eddy loss because the flat surface is in no way a streamline body. All ships, including the very early attempts equipped with flat lifting surfaces, have failed to get off the ground.

Now, an airfoil, or a bird-wing section with a thick entering edge and a thin trailing edge, is an approach to a streamline body. Its resistance to forward motion is much less than that of a flat section, even though the thickness of the flat section may be only a small fraction of the thickness of the airfoil. The air-stream is broken up by the flat section while it flows smoothly over the streamline form of the true airfoil.

The lift-drag ratio, or the ratio of the weight lifted to the forward drag, is the measure of lifting surface effectiveness. Thus, if 20 pounds are lifted by an airfoil for each pound of forward resistance, and some good airfoils will do this, then the lift drag ratio is said to be: "L/D = 20." The lift-drag ratio of a flat surface is more in the nature of L/D = 4. This will give you a general relative idea of flat surfaces and airfoils.

* * *

QUESTION:—George P. Denby, Richmond, Va. *How is centrifugal force generated? That is, when we swing a weight around in a circle, what creates the force that tends to pull the string out of our hand? Is this the same force that makes an airplane skid on a turn and tends to burst a propeller?*

Answer:—IN the first place you have used the wrong word to express your idea. The force

(*Continued on page* 195)

How to Convert Your Present Camera for Air Use

by WILTON FISHER

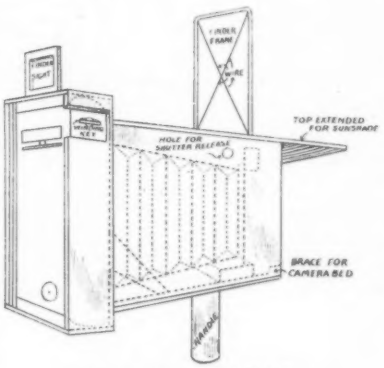
A simple and inexpensive method of converting a hand-camera into an aerial type

FOR a dollar, or less, it is possible to convert any good roll film or filmpack camera into a thoroughly practical aerial camera. The only material needed is a piece of three-ply panel board, nails and a little paint. This will be good news to the many flyers who are interested in photography, but who are not willing to pay the price demanded for standard aerial cameras.

Primarily, there are only two things that will prevent the owner of an ordinary camera from taking pictures from the air. First, the propeller slipstream, and second, the wind caused by the movement of the plane itself. The force of the wind will quickly collapse the bellows and twist the lens mount of an unprotected camera. Therefore, it will only be necessary to make a box that will completely enclose the camera and still leave the necessary adjustments convenient for use.

Since no two different kinds of camera will be accommodated in the same size and shape of box, no exact measurements can be given, but the drawings will clearly show the general form of the box for a typical snapshot camera. The individual camera owner can easily adjust these dimensions to fit the camera that he owns. It is only necessary to make sure that the box fits securely without binding and that it does not interfere with the camera adjustments, such as film-winding key, focusing screw, etc.

For the best results the camera used should have a picture size of not much less than 3¼x4¼. It should be fitted with an anastigmat lens having an aperture of at least F8 and a shutter capable of giving speeds of 1/50 of a second or less. Most of the moderately priced modern cameras can more than meet these requirements.



The constructional details.

The completed box should be painted inside with a dead flat black paint to prevent reflections, while the outside can be stained any desired color. After the box is completed, it will be necessary to construct or purchase a direct view finder to take the place of the regular "peep" type finder provided with the camera box.

A compact type of direct view finder can be purchased from any photo supply house for a small sum, or a finder can be constructed as shown in the drawings.

The rear part, or finder sight, is cut out of either thin, strong wood or metal, and the sighting hole should be about an inch square. The finder frame is best made of heavy wire and is the exact size of the picture taken by the camera. The installation of the finder frame will have to be carefully performed to insure accuracy.

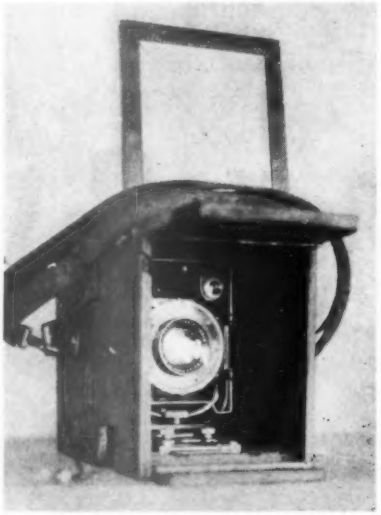
The best method is to place the camera in the completed box, remove the back and place a piece of ground glass or fine tissue paper flat against the part ordinarily occupied by the film. Next, carefully focus on some distant object, noting what portion of the picture appears in the center of the focusing screen. Then move the finder frame back and forth until the same portion appears in the center of the frame when looking through the finder sight.

Now for a few hints on using the camera. When making an exposure, do not rest the camera directly on any portion of the ship, for the vibration will blur the picture. Do not point the camera directly toward the nose of the ship, but shoot toward the tail whenever possible. Hold the camera firmly, but not too tightly, when pressing the shutter.

The exposure of your picture, taken from the air, will depend on your lens and shutter. The shutter speed necessarily depends on two factors. One is the speed of the plane and the other is its altitude. The slower the speed of the ship, and the greater the height, the less will be the required shutter speed. Most of your pictures will be made at heights of 3,500 feet, or less. The cruising speed of the average plane will be around 90 m.p.h., though if the pilot is obliging, he can pull the ship into a stall. At the peak of the stall, the plane will practically stand still for a second.

Good pictures can be taken in a stall, at comparatively low altitudes, with an exposure of 1/50 of a second. This shutter speed will also suffice at greater heights when the plane is in full flight. At lower altitudes, and greater speeds, the shutter will have to be stepped up to 1/100 or 1/150 of a second and speeds up to 1/300 of a second are useful.

For your first trial, pick out a clear day and load your camera with the new fast roll film or filmpack. This costs only a few cents extra and is twice as fast as ordinary film, besides being more sensitive to differently colored light rays.



The finished job with the finder shown on top of the camera.

An aerial view taken from an airplane by the converted camera.

The Round Robin Club

A correspondence plan for POPULAR AVIATION readers.

THE Round Robin Club grows and grows. Fourteen clubs now formed and going strong. Fourteen clubs, that means 140 members. One hundred and forty young people exchanging their ideas and getting new ones.

That's great! Every few weeks, club members give us new ideas that make P. A. material better. In this way it really becomes *your* magazine and we know how to print the kind of material you want.

Work has been piling up on Mr. Rathbun in the past few weeks and he's sorry there's been some delay passing the letters along. He now has an assistant, Mr. Hawley, who is turning out the stuff just as fast as he can.

All the recent letters are good and some, particularly a story of the army air-show in Chicago, were great. The air-show letter was written by Howard Pack of Club No. 1. We wish there were space to print it here.

Quite a few girls have asked to become members and they are very welcome. We'd like to see more, especially some older ones. The last is foolish—all girls are young.

We get so many fine letters and ideas that we want to pass 'em around to the different clubs. Don't know just how to do it. Most likely they will soon appear in this section of P. A. What do *you* think about it?

There are complaints that we don't answer some of the many questions asked in letters. Well, a lot of the questions are of such general interest that we use them in P. A. Some of them are answered in articles and stories. So, if you don't get answers to your questions in the letter, next time it comes to you, just keep your eye on P. A. and you'll get the answers.

One of the fellows enclosed a personal letter to ask a question. It was turned over to the "Q. & A." department.

Once in a while we get a card from a member asking why he hasn't received the letter. We don't know ourselves, but our guess is that it has been held up by some other member. If you write to the other members, you'll find out quicker than by writing to us.

We'd be glad to help you, but the chances are we don't know any more about it than you do. It usually takes at least twelve weeks for the letter to go around, so don't get impatient. It *should* move faster, but unless the members write quicker, there's no chance of speedier circulation.

We are glad to welcome these new members, who make up Club No. 14: (2) Chas. J. Landey, Jr., 2413 Franklin Ave., New Orleans, La.; (3) Charles A. Shaw, 6418 N. Washtenaw Ave., Chicago, Ill.; (4) Ralph R. Denien, Salem, Ind.; (5) Steven Wasnewoski, 156 Grand St., Brooklyn, N. Y.; (6) Edmond Bond, Route 4, Cuero, Texas; (7) Paul Scheidecker, 313 14th St., West New York, N. J.; (8) William A. Back, 406 Anthwyn Rd., Narbeth, Pa.; (9) Joseph Whalkos, 8203 Indiana Ave., Detroit, Mich.; (10) Ted Buller, Ridgetown, Ontario, Canada.

Some day I hope we'll have a flock of new members from Europe and other lands. Then we'll get news from all over the world. If you have friends in other countries, write to them and get them to join the Round Robin Club.

Have you noticed the new member from Canada? He's especially welcome because they have aviation ideas up there that will be new to some of us.

Until next month—best o' luck!

The Akron's Power Plant

A unit power plant on the "Akron."

AN adjustable propeller is the answer when the Akron, pride of the United States Navy and the largest lighter-than-air craft in the world, wishes to gain altitude. The mammoth dirigible's propeller is here shown in horizontal position as it would appear in climbing. For horizontal propulsion it is turned into the vertical.

He Flies in His Slippers

CHARLES BUTLER, the British aviator who set a new world record early in November by flying from England to Australia in 11 days with his tiny Comper-Swift airplane, believes in solid comfort and preparedness. Butler wore carpet slippers throughout the flight and his meager equipment included a tomahawk for use in case he was forced down and attacked by savages.

A Compressed Air Type Catapult Launching a Bomber

HERE is a new type of land catapult immediately after launching a twin-motored bombing-plane, in tests at the Royal Aircraft Establishment at Farnborough. This catapult is entirely different in design from that used for launching planes from ships.

Just after launching a bomber from the catapult.

A Nice Looking Trainer—What?

GEORGE ADAMS, Mordovia, N. Y., has built the training glider shown from a well known kit. He had a friend test-hop it for him, and so satisfactory was the job that the only alteration was a re-adjustment of the stabilizer. Since that time, George has made over 70 hops with no serious trouble.

George Adams seated in his "P.T." glider, constructed by himself.

Lindbergh's Class is Flying

IN MARCH, 1925, eighteen young men graduated from the United States Air Service School at San Antonio, Texas. Seventeen members of the class are still alive and flying, and included in the original group is Col. Charles A. Lindbergh.

A "chain letter" has just reached Captain Eugene Stevens, one of the class members, after a three-year jaunt around the world. The latter, evolved as a means of communication between the graduates, was started on its long journey in 1928 by the president of the class.

Each member, upon receiving the letter, writes an account of his aerial activities since leaving school and sends it on to another classmate. The contribution by Col. Lindbergh is a short and characteristic account of his doings since graduation.

Build Your Lightplane Correctly

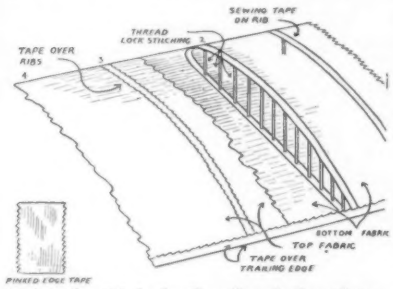
by F. NAGLE

Mr. Nagle discusses shop work and shop methods with the amateur lightplane builder

Part II

LIGHTPLANE construction demands the greatest of care. No detail is too small to overlook. First, we must have quality materials, as explained in Part I of this article in the February issue. Second, the proper tools must be employed so that the work can be done satisfactorily from a mechanical standpoint—a fact also remarked in our last issue.

And now we come to the really vital point of all—the method of handling the work and the operations involved in



Sewing the fabric to the ribs of the wings, taping and other covering operations.

building the ship. Because of the great variety of materials employed in airplane construction, wood, metal, rubber, fabric and other materials, the builder must be the master of at least a dozen trades, and it is the purpose of this section to show how these operations are best performed.

How to cover the wings, and how to dope and varnish them after covering, is a real art in itself seldom encountered in other constructions. Then, comes the matter of welding and of handling the special metals employed. All of this requires strict attention on the part of the builder to avoid failure of any of the many members entering into the construction.

For the covering material, which usually consists of cloth, dope, thinner, waxed linen thread, pinked-edge tape and sewing tape, the best is the cheapest in the long run. The initial cost of the better materials will be somewhat greater, but if your plane is to be used often or left out in the weather, you will soon be sorry if poor material has been used. This covering material is best purchased from some recognized supply house and then you will be sure of the best quality, at the price paid.

COVERING AND DOPING

FOR working the covering material, you will need the following tools: Long needles, small straight and curved needles, thimble, dope brushes of good quality and sandpaper of assorted grades to sand down the doped surfaces if necessary.

Assuming that the ship is ready to cover, you should first cut out the cloth to fit the parts. In the case of wings or tail surfaces, and for some simple shaped fuselages, the fabric is best cut to fit. It is then sewed into an envelope of such shape as to fit snug over the part to be covered.

When this has been done, the cloth envelope should be slipped over the frame and the edges sewed with linen thread. At the same time, the fabric should be drawn as tight as possible. When the fabric has been sewed all round the edges, you are ready to sew the cloth to the ribs of the wings and the tail surfaces.

First, you should get some sewing tape, which is a tape of about the width of the cap strip. As it comes in varying widths you should get the size nearest the width of the cap strip on your ship. Then run it over the rib next to the fabric, pinning at the ends of the ribs to hold it in place while the sewing to the ribs is being done.

Use a long needle (about one foot), for this operation, and stitch the fabric to the ribs in the same manner as shown in the drawing, Fig. 1. Linen thread (waxed) should be used, and the stitches made about every four inches. After this is completed, remove the pins from the ends and trim or cut the sewing tape even with the trailing and leading edges of the wings.

If you have completed the above mentioned operations, you are now ready to apply the first coat of dope. This should be fairly thin and should be brushed in well. Allow about two hours for drying in the sun or overnight in cool weather. After this first coat is thoroughly dry, you are ready to dope on the pinked edge finishing tape.

First, brush a coat of dope over the rib and sewing tape and be sure that the dope has penetrated through the tape. Then lay the pinked edge tape on the doped portion, being sure that it is centered over the rib. Now brush the tape down well with the dope brush, and then give the tape—and fabric immediately around it—a good coating of dope. When taping the edges of the wings, etc., the same methods are followed, but the tape may have to be cut as shown in Fig. 1 when taping around curved parts.

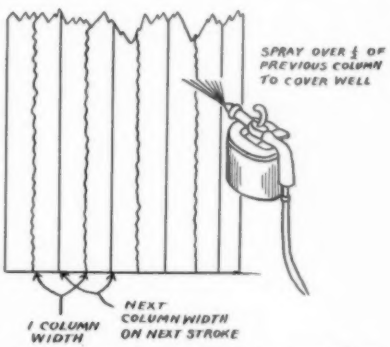
After all the tape is on apply the next three coats of dope, allowing ample time for drying between coats. If an aluminum or silver finish is desired, the aluminum powder should be mixed with the dope for the last three coats. If you intend to give your ship a lacquer finish, the powder should be mixed with the last two coats of dope so that you will have an aluminum undercoat upon which to spray your lacquer.

PAINTING

IT is a good idea to buy finishing materials that will stand up, and to pay a higher price for them, than to buy cheaper finishes and then have to repaint your ship at the end of six months. Economy at the beginning may turn out to be expense at the end.

The following materials will be required to finish your lightship: A good grade of spar varnish or Lionoil for finishing woodwork, also as an undercoat on metal surfaces. A good quality of lacquer of the color you desire, some thinner and anti-blush reducer if you intend to spray paint your ship.

The anti-blush reducer serves to lengthen the time required for drying, thus keeping the lacquer from blushing or turning whitish in damp weather or on moist days. The varnish, or Lionoil, can be either brushed or sprayed on. Spraying is best for the wing woodwork or for any parts made up of a number of small pieces. Brushing is decidedly inferior to spraying in the case of the wing painting, though it is probably easier and better to brush the varnish on such parts as longerons or other long thin open members where



Applying dope to the fabric by means of an air-gun.

much of the spray would be wasted.

PAINTING

IN mixing lacquer for spray work, mix equal parts of lacquer and thinner (or reducer) on damp days. The spray gun should be held (if of the fan spray type) so that the spray is horizontal while the gun is being moved vertically. A lapover of about one-third the width of the spray column is

allowed while the next column is being sprayed. (See Fig. 2.)

About three or four spray coats should be given the wing for a good finish, and if a high gloss finish is desired, the surface should be given a coat of clear lacquer over the last coat. The use of masking tape and paper is clearly shown in Fig. 2. Masking tape and paper are used when two-color jobs are being sprayed to prevent the spray of one color going on some surrounding different colors.

A condenser should be on your spray outfit, if of the air-compressor type, to prevent water from entering the lacquer container on the gun.

THE WING STRUCTURE

IT is presumed you have in your possession the plans of the ship you intend to build. If this is the case, then you should consult the plans for the proper sizes of stock you will need for building the wings. When you have obtained your stock you are ready to begin construction.

First build the ribs to the dimensions shown in the plans, using casein glue for the glueing, and when these are completed they should be inspected for any defects in construction. If everything is O. K., they should be given a coat of varnish or Lionoil, care being taken that none is applied where glue is to be spread.

Upon completion of the ribs, the spars should be cut to size, and the fitting holes drilled at the correct places. The ribs are now to be slipped on the spars, care to be taken that the ribs are in their correct places and that you make *one right* and *one left* wing. The ribs should not be nailed to the spars through the cap strip, but rather through the side piece of the rib which lies on the side of the spar.

When all the ribs are in place, the fittings should be bolted on, and the drag and anti-drag wires are then cut to shape and size. When making the terminal loops in the hard wire, be sure to slip on both ferrules before the terminals are formed to shape. Square up the wing, one bay at a time, beginning with the inner one. When the structure is square, the turnbuckles should be safetied with copper wire.

The leading and trailing edge pieces are next put in place and firmly fastened. Then the bow end is fastened to the ends of the spars. Any other wooden braces are now put in place, and after the wing has been painted with spar varnish or Lionoil, it is ready to cover.

It should be remembered, however, that when two surfaces are to be glued that there should be no paint or varnish beneath the glue joint. The glue is useless on painted surfaces. When cutting out the ailerons, if such needs to be done, be sure that you cut only the required number of ribs, and that the ends of the ribs are not split when they are nailed to the aileron beam. Be sure the aileron does not bind, either

(*Continued on page* 192)

One Big Piece of Luck

AN amazing parachute jump was made by airmail Pilot James Johnson when a wing of his plane buckled over Allport, Pa.

Johnson was unconscious most of the time his plane was falling and cannot remember having jumped. He was en route to Cleveland from New York, flying high to take advantage of tail winds, when the wing folded up. At the same moment the instrument board was displaced and struck him in the face, knocking him unconscious.

After dropping part of the way, the pilot regained consciousness, then lost it again and did not remember anything until he awoke on the ground and found farmers dashing cold water in his face.

Pilot Johnson apparently went through the motions of jumping and pulling the parachute ring unconsciously. Farmers who found him said he did not leap until the ship was within 500 feet of the ground. The plane cracked up 300 feet from the point Johnson landed.

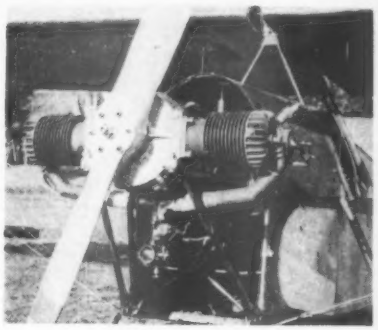
This Pilot Flies His Glider Blindfolded

AN ex-army pilot, who has taken up gliding for pleasure, tries *blind gliding* and finds it much more interesting than blind-flying. Without any instruments, and using only his senses, this man glided some three-hundred feet in a trial of this new type of gliding.

He has been practicing this form of gliding for the past few months and has had remarkably few accidents. Only trained men with years of experience should attempt this stunt.

How the glider is flown blindfolded. What a chance to take in the dark!

A New Lightplane Engine



A new two cylinder engine for light planes.

EVERY day something new is done to improve the lightplanes. More and more the private owner is taking to lightplanes. Les Long, of Cornelius, Oregon, has brought out a new engine after considerable experimental work. Mr. Long believes that this engine "should just about settle the engine question for light planes."

The engine is a 2 cylinder type working on the 4 cycle principle. It has 2-in. valves. The crankshaft and the connecting rods are of special alloy steel. The lubrication is kept at high pressure by gear pumps, one of which is used for scavenging. The mounting is a simple four-bolt, motor bearer type.

Mr. Long has made three engines of this type and he has thoroughly tested them. Installed in a 600 pound plane it takes off in about 100 feet, with a climbing rate close to 1000 feet per minute. 2500 r.p.m., with a 5 ft. 2 in. prop. develops about 30 hp. The total weight is only 95 pounds, including the Bosch mag. and Zenith carburetor. This engine sells for only $195.

Mr. Long does not say what the top and cruising speeds of this plane are, nor does he say anything about the gas consumption. The picture shows us that it is a neat, very compact engine, and well designed.

If Mr. Long will tell the performance of this engine when mounted in a plane we will be glad to pass the information along.

Small Plane Takes Off with Tail Down

C. A. BUTLER, who recently broke the Australian time record from London, owns a fly-size Comper-Swift plane, so small that it can only take a slender pilot in the cockpit. This monoplane is very speedy, and the prop almost touches the ground, so that it has to be flown tail-down at the take-off. Pilots must have considerable air hours to fly the ship properly, and in the hands of such it is a wonderful job. There are but few Comper-Swift ships in commission, one of them being owned and flown from Renfrew, Scotland.

Practical Lessons in Flying

by JOHN B. RATHBUN

Our heroes, Bob and Ed, try their hand at blind flying by the use of instruments

BOB, the flight student, was looking over the new contraption with great curiosity. Beside him was Ed, the pilot-instructor, who was grinning from ear to ear but was saying nothing. The more Bob looked, the more puzzled he became until he could stand the strain no longer. "Say, Ed, for Mike's sake what is that thing? Is it to keep the rain off my little head or are you going to make a shipment of wild-cats—or something?"

"Naw," said Ed. "That's a dingus for giving you a permanent wave—haw-haw."

"Well," asked Bob, "I don't see any reason for you getting so fresh about it. I've been standing here fifteen minutes and all you've done is to grin like a blame fool and don't tell me a thing. All I can see about it is that it's a little covering for the rear cockpit that folds up and down, but I think someone made a big dumb trick when they didn't put celluloid or glass in it so you can see where you are going. If you pulled that thing over your head you couldn't see a blamed thing."

Ed waited for another minute or so, just to tease Bob, and then spoke his little piece. "That, Bob, is the original one-man top. Wind-proof, air-tight and sight proof. If you can see through that I'll make you a present of a hand decorated doorknob. And the less you see, the more you're going to learn."

"Oh, come on and stop stalling," cried Bob, now thoroughly worked up with curiosity. "Am I supposed to get in there and have you pull that thing down over me so I can't see?"

"You sure are going to have that one-man top pulled over you and you're going to fly that way too—or at least you are going to try. If you would use your head a little instead of shooting so many questions, you would finally get the fact into your system that this little derby hat is for the purpose of teaching you blind-flying. You saw the announcement on the bulletin board this morning that we are giving courses in blind-flying, and you're the first goat that we are going to try it on."

"Well, what do you know about that," Bob exclaimed. "So that is the beginning of that new course, and I'm going to distinguish myself by being the first one to try it? Attaboy, I'm strong for this racket. It looks interesting."

"Yeah, it'll be interesting all right—'specially for me, the innocent bystander, who usually gets it in the neck. You are to get into that rear cockpit, with me in the front pit. I'll pull the hood down over you, and from that time on you're going to fly entirely by instrument."

A good takeoff by Ed, flying blind.

"I can see how I can keep my direction with the compass and my altitude with the altimeter all right, but how the heck am I going to keep her leveled off properly? Of course, I can tell when I'm all out of line or upside down, but this won't keep me from stalling her or spinning. You remember when we flew into that cloud the other day and I came out on one wing because I couldn't tell whether she was level or not?"

"IF you'll take the trouble to lift that hood again, you will see that there is a new instrument board with some new instruments on it. You have all the old instruments with you, plus a new artificial horizon. This instrument will tell you whether your wings are leveled off or not, without the necessity of watching the horizon. If we had this instrument with us, the time that we flew through that cloud you're speaking of, you would have come out of the cloud straight instead of being cocked up on one wing."

"Do you mean to tell me that this instrument will tell me what wing is low, whether I am climbing or diving, just as if I were free to watch the horizon?" asked Bob.

"Absolutely," returned Ed. "That little model airplane behind the glass represents the position of the ship, while the white band is the horizon. The bar at all times exactly corresponds to the position of the natural horizon.

When the left wing of the ship is low, then the left wing of the model is low. If the white bar is above the model, this indicates that the ship is diving. If the white bar is below the model, then the ship is climbing."

"I see," said Bob, "and I suppose that we still have use for the bank-and-turn indicator, the compass and all the rest of it, down to the oil pressure gauge. Well, when do we begin?"

"Right now—or at least as soon as you've wound up that engine and got it warmed up," replied Ed. "Now hop to it so we can get rolling some time this morning."

Bob took his position in front of the ship and grasped the prop, while Ed climbed into the rear pit. "Contact," yelled Bob. "Contact," replied Ed. With a few quick flips of the blades, the engine started her song of liberty and Ed jockied the throttle and mixture until the exhaust was coming regularly with only a skip now and then. Finally when she was warmed up, a matter of a few minutes, Ed climbed out of the hooded rear cockpit and jumped into the front pit, from which he was to direct further activities.

"Say, Bob, our first little trip after take-off will be taken with the hood off the rear cockpit so that you can observe the real horizon and the artificial horizon at the same time. After you kinda check up on the relation between the two, then we'll land and I'll seal you up."

Bob gave her the gun, and after a short run against the wind the ship took off into the southwest. Finally, after reaching an altitude of about 1,000 feet, Bob took his first glance at the artificial horizon. He was now flying straight ahead—all leveled off. The white bar on the artificial horizon was now on the wings and parallel to them, exactly in the same position that the actual horizon was located in respect to the ship.

"And now I will see what happens with that dingus," thought Bob as he gave her a little left-stick.

Down went the left wing of the model just as promptly. Bob now gave her right-stick—and down went the right wing of the model, the white bar representing the horizon remaining as before.

"Now I will see what happens when I give her a little climb," said Bob to himself as he pulled back on the stick. Up went the nose of the ship, and at the same instant up went the nose of the model airplane on the artificial horizon. Then Bob brought the stick to neutral, and just as quickly the model came back into its original normal position. "That's mighty fine," thought Bob. "It'll be Jake, O. K. and

all the rest of it if the machinery don't get stuck or go on the blink."

NEXT came a good pull back on the stick and the ship went into a steep dive, the stay wires whistling. Just as quickly the model on the indicator faithfully went down below the white bar, indicating the dive. Wonderful. Bob thought that he was already the master of the ship, even with the hood hatched down over him. Enthused with the idea of trying this out at the first possible moment, Bob held her nose down for making the landing so that Ed could hatch him in.

"Say, wait a minute," came Ed's voice over the phones. "We'll do just a little more experimenting before you're sealed up in your cage. We'll see whether you can come anywhere near to the runway, just keeping your head down where you can't see anything. Take a good look first to see where you are now, and then see how you can operate using only the compass, artificial horizon and altimeter."

Bob looked over and noted that he was about ten miles southwest from the airport and there had been practically no wind at all when he started, hence there was no need of taking drift into account. One glimpse, and then he ducked his head down below the cockpit coaming, where he could see nothing but the instruments. There were a few holes, now and again, that rocked the ship a little, making it necessary to make slight corrections with the stick, but outside of that the day was calm and ideal for this first experiment.

Bob now gave her right rudder and right stick, so that she banked up around a gradual turn into the northeast, according to the readings on the compass. He knew the course without looking, and getting his speed from the air-speed meter, he could make a rough estimate of the time required for bringing him over the airport. Ed sat idle in the front pit while this was going on, resolved to say nothing until Bob got into some predicament that demanded attention.

On and on they flew, northeast, Bob constantly noting the artificial horizon so that he maintained normal flight. He kept the wings of the model literally plastered on the white line, and as no sarcastic remarks had come from Ed, he felt that he was hitting it off in fine shape. He had some altitude, probably because of his speed, but as he wished to lose altitude this did not demand correction.

NOW came the critical moment when Bob estimated that he must be about a mile from the airport and must start his landing. Forward went the stick slightly, and promptly the model ship's nose went below the white band. If he were on his course, then this would bring him exactly in the proper position. Keeping an eye on the model horizon, and watching the altimeter at the same time, he saw the altimeter needle descending regularly until it was at 500 feet. Just where was he, anyway? The temptation for looking over the side of the ship was almost irresistible.

Then came the first news. "Overshot by half a mile—too far east—but not bad at all—have hope for you—pull her up and hand her over to me," said the phones.

Bob, at a jump, straightened up and looked over. There was the airport, but, as Ed remarked, he had overshot the mark and was too far to the east. Ed had the ship in hand now and was bringing her down on the north runway. Bob always called this runway the "lecture platform," for it was here that Ed always landed when he had a lot of lecturing to do after a flight. They landed, only as Ed could land a ship, rolled a bit and then came to a halt.

"Well," said Ed as he climbed out of the pit. "That was pretty good for the first time—so good that I think it was mostly good luck. You took the turn well and kept her levelled in good shape. There was only one thing that you didn't do, and that is, you didn't watch your air-speed meter close enough and therefore failed to notice that your speed was above normal on the glide. This is what I think made you overshoot."

"And another thing that made me overshoot was the fact that I guessed at the distance, and what I guessed as being ten miles might have been shorter or longer," said Bob. "Anyway, I think I have the general scheme, and if I can keep my eyes on a dozen different instruments at once, I can make the grade—you bet."

"What you need, Bob, is a robot pilot that will fly the ship for you so that all you have to do is to steer it. When we get that far along, there'll be no need for pilots nor pilot's licenses—and that lets you out. Well, hop in and I'll screw down the hood so you can't peek out while I'm not looking. Go to it—kid, go-to-it."

With one jump, Bob was in the cockpit and with one sweep of the arm Ed had the cover down and safetied it in the closed position so that it could not blow open in flight. He adjusted his eyes to the darkened interior, and then gave the customary three knocks that signalled his readiness.

"Now, boy," I'll do the take-off for you and then I'll hand her over to you at 2,000 feet. What you do after that is your business until it gets so bad that I will have to make it my business. Now, I'll shoot."

Open went the throttle and the ship taxied out to the north fence, swung around, and then went roaring down the runway to the southwest. Bob was having a novel experience, cooped up like a chicken in a crate, but he knew from experience just what was happening around him. He felt her point up while the bumping grew softer and softer until it finally stopped.

They were off, and Bob got quite a

(*Continued on page* 196)

Ben Lyons Packs a Pack

Suspended from the ceiling is the dummy used for testing parachutes.

THE popular movie star, Ben Lyon, is shown learning all about parachutes from his squadron commander, Lieutenant W. R. Sweeley. Ben is a shavetail in the 322nd Pursuit Squadron of the United States Army Air Corps and takes his flying seriously.

Maybe his superior officer is remarking, as did the Cockney major of the British air force to a class of American balloon observers during the war: "Of course, gentlemen, one always has one's parachute—and sometimes it opens."

However, the gentleman so nonchalantly hanging from the ceiling, is the stuffed gentleman that takes all the worst risks. If the 'chute don't open, then he goes "k-k-boomp," but it doesn't disturb his hay filler.

Note: We were unable to learn the identity of the dignified figure in goggles. It isn't Ben, however. Ben's under the hat.

Daredevil Dale Jackson Killed

DALE JACKSON, one of the most celebrated of stunt flyers, was killed at Miami, Fla., January 6 while stunting in an experimental job.

Dale "Red" Jackson, together with Forrest D. O'Brine, established a world's record refueling endurance record at St. Louis in 1929. After this record was broken by the Hunter brothers in 1930, Jackson and O'Brine again took off at St. Louis and stayed aloft for 647 hours.

At the National Air Races, last year, Jackson flew a land racer to third place after flying through the top branches of a tree and breaking most of the interior wing structure.

This occurred on the fifth lap, but Jackson kept the ship in the air at 200 m.p.h. until he finished the tenth and final lap.

In the death of Dale Jackson aviation loses one of its most colorful and best loved figures.

XUM

New Ideas for Our Model Builders

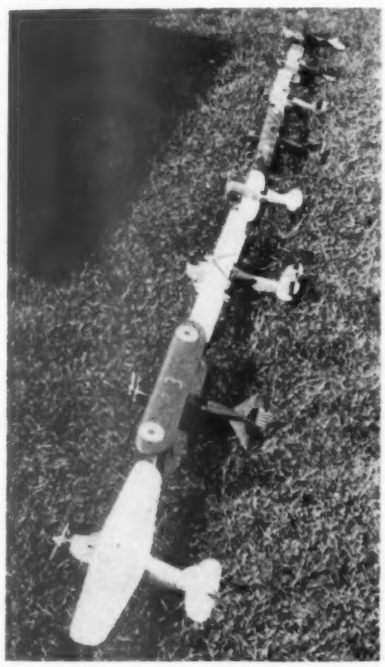
When Model Airplanes Have Combat Practice

CRACK! Two Invincibles meet in midair . . . one falls to earth . . . another victory for the Allies!

That's the way William Winter and his friends of the Invincible Model Aero Club, Bergenfield, N. J., are varying the program of model-building. The Invincible club is a new outfit with headquarters at 42 Somers Avenue.

William has given us some great dope which we pass on to you. Members of his club use their model planes to stimulate the activities of airplanes in war and in commerce.

For example, they put an Allied plane at one end of a field and a German plane at the other. Launched at the same time, they fly toward each other. The one in best fighting position when they pass is victor.



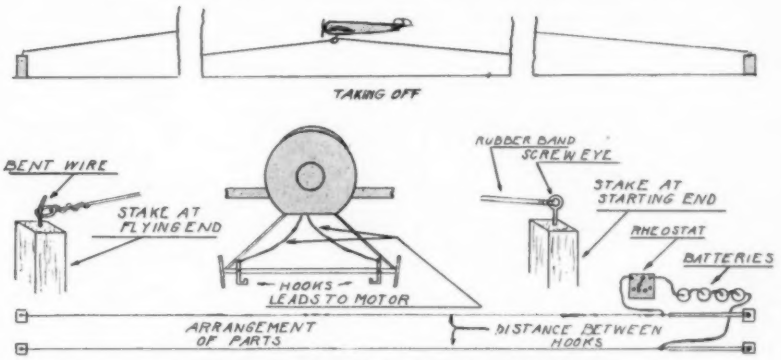
A "line-up" of war model planes.

Sometimes, several planes are released from both sides and grand dogfights result. When two planes collide in midair and only one falls, the one still aloft wins the battle.

"Ocean flight" is another trick. Models that will clear a certain swamp are winners. There are races, too. The boys built miniature pylons on a circular course and some interesting things happen.

Ideas like these are great. A lot can be learned from them.

Improving the Power Plant of the Model Plane



Layout of methods used for powering model planes.

THE American boy is never satisfied. Fine. That is the real reason why he is always improving on what he has. As soon as he had mastered the use of rubber bands to power his model planes, he began to look around for new and better means of propulsion. The ideas that have been presented would fill volumes.

But here is another idea. We are glad to discuss this one for it has the ear-marks of a real idea. Unfortunately, Ben Smith of Sea Cliff, N. Y., who gives it to us, has not been able as yet to prove that it works. Here is his idea in his own words.

The model, itself, would be very light and would be built right on the motor. The motor would have to be trimmed of all excess weight. The two wires of the motor extend down along the two sides of the landing-gear and bend up in the shape of a hook. The wires should be rigidly connected to the landing gear.

On the ground are two wires stretched between stakes. The distance between them is the same as the distance between the landing wheels. At one end, the starting end, there are rubber bands to keep the wires somewhat tight and straight. At the other end, the wires are fastened to bent nails by means of rings. A suitable battery and rheostat is installed at the starting end.

When ready to fly, the plane straddles the two wires and the wires are hooked over the hooks. The power is turned on and the plane picks up speed. When sufficient speed is attained the plane will lift, pulling the wires up with it. As the model nears the end of the course, it will pull the wires free from the nails, and in turn, the wire will slip off the hooks. The idea is, that after leaving the wires the plane will fly of its own momentum.

Well Ben, the idea looks good. Of course, it will be a problem in design—figuring lift and all that sort of thing. And the setting of the elevators and setting the landing gear as well.

Here is a real challenge to those of you who think you are some punkins in the game.

How to Transfer the Outlines of Ships

ONE of our readers, among other readers, tells us that he likes our drawings but that he wishes we would put all of the dimensions on them. He claims that it is too difficult to get accurate dimensions. He accompanies his remarks with a photograph of a Nieuport model that he has just built.

Now, we don't agree with him. In the first place it would make the drawings too confusing if all of the hundreds of necessary dimension figures were placed on the sheet. Second, if the dimensions were marked on, then they would be good for only one size of model, and to make a model with any other span would require a whole lot of figuring with possible mistakes.

We suggest that he provide himself with a pair of dividers by which he can transfer the outlines of the drawings to his layout sheet. In this way, it is not difficult at all to get the proper sizes—much easier than with a sheet full of figures. The reason that we are so sure of this matter is the fact that we have made dimensioned drawings before, and our readers had more trouble with the figures than they have had by scaling off the sizes.

Further, if the reader is a confirmed model builder, he should procure an "architect's scale" which will give him a variety of reduction ratios in feet and inches.

XUM

MODEL DEPARTMENT

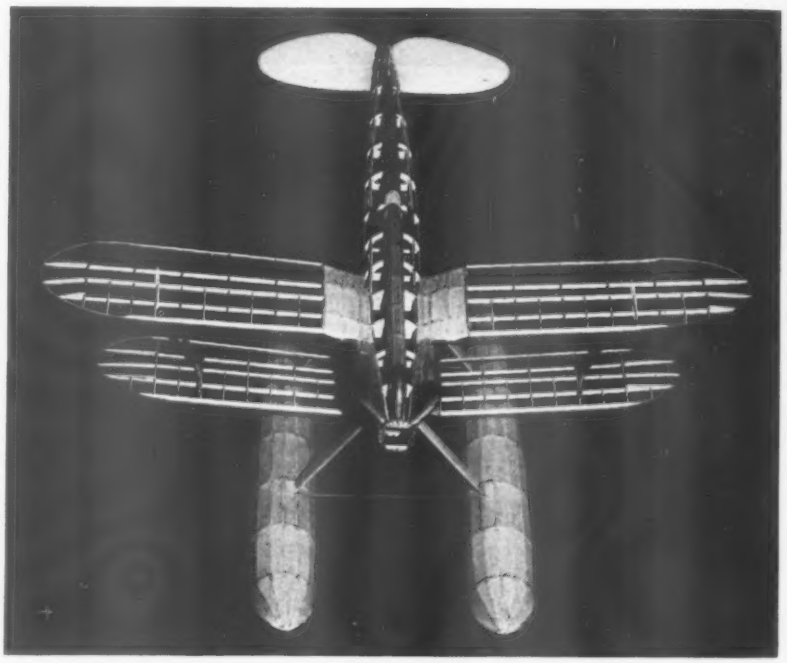
by JOSEPH S. OTT

HOW to Build the GLOSTER IV Seaplane

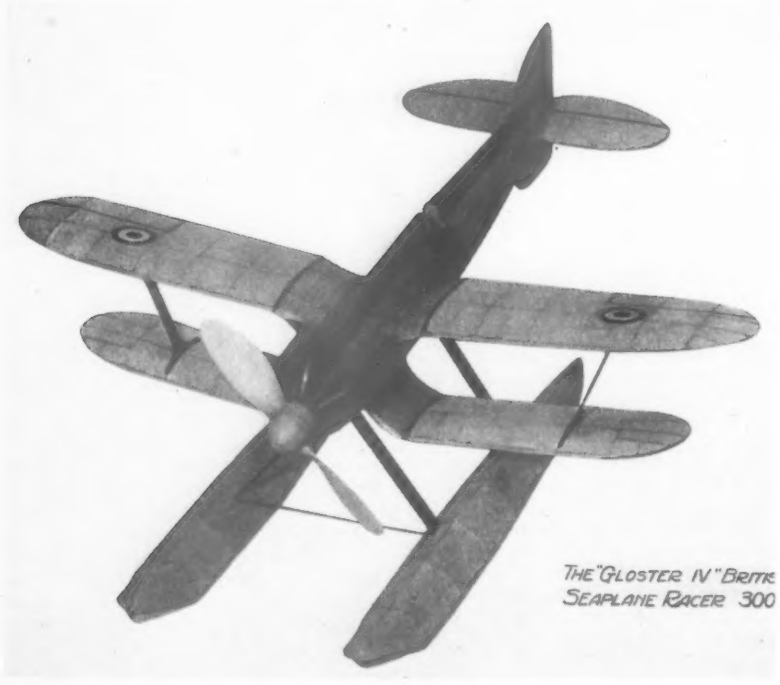
IN DEVELOPING fast seaplane records, the British worked on a series of Gloster planes, employing stream lining to the finest degree and using high powered motors.

The Gloster IV Biplane, illustrated, is one of these designs. The motor has three banks which is forwarded into the fuselage and ending up by stream lining into the wings on each side and cutting as a fairing for the pilot all the way back to the rudder post.

The entire length of the body on this particular plane is just a fraction short of the wing span. The long tail gives a good stability and in a fast plane of this type, utmost stability is a necessary feature. The rudder extends to the top and lower sides of the fuselage. The floats are very long and project almost the entire length of the fuselage.



Completed framework of Gloster IV Seaplane completely assembled and ready for covering.



The Gloster IV seaplane covered, decorated and ready to fly. A classy scale model of a modern seaplane.

The completed model as illustrated, finished ready to fly, having a thirty inch span, weighs four and one-half ounces.

Abbreviated Building Instructions

1. Wings
2. Body
3. Rudder-stabilizer
4. Floats.
5. Covering
6. Assembly of model
7. Propeller-motor stick
8. Shrinking-covering
9. Waterproofing floats
10. Flying.

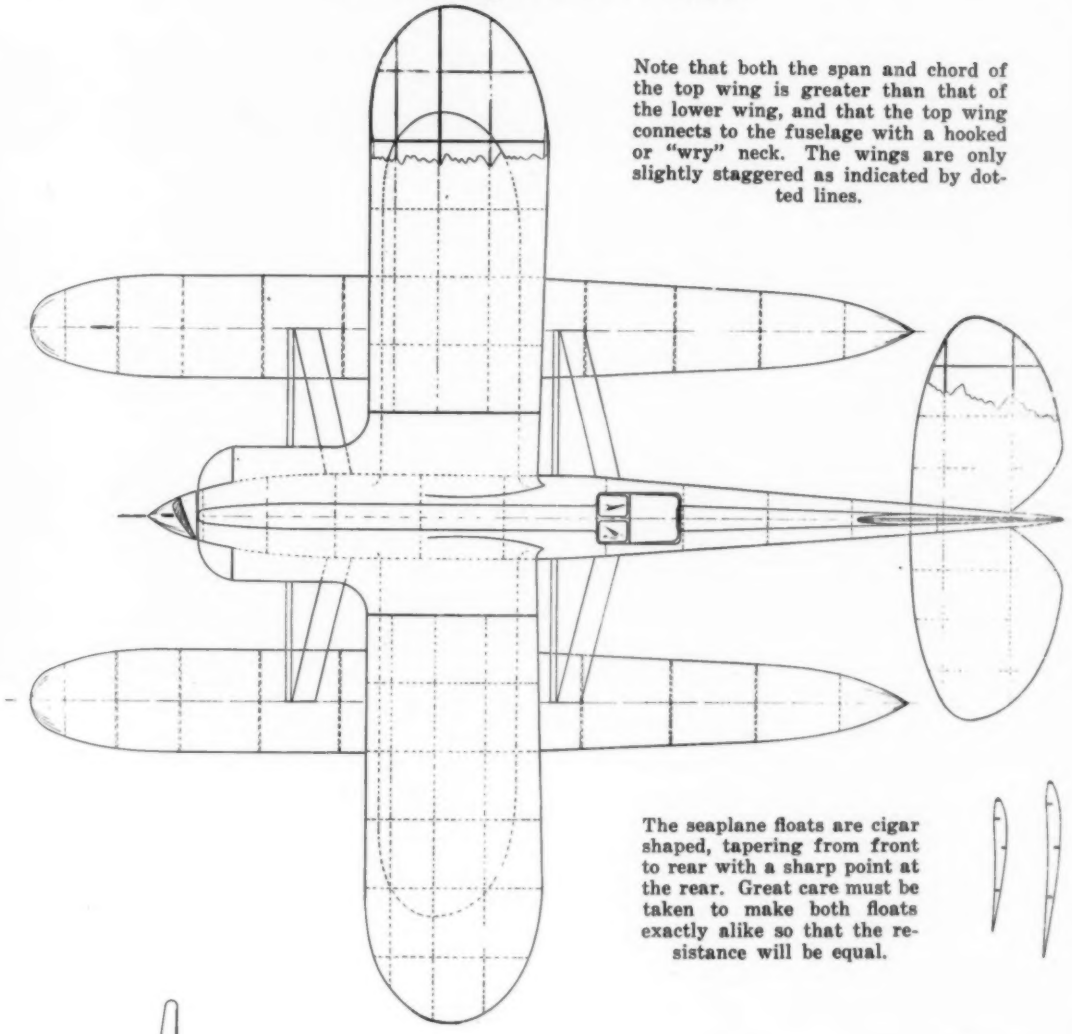
MATERIALS

1. Body—10 pieces — 3/32x3/32x30" Balsa.
2. Landing gear—3/32x1/4"—Balsa, hard.
3. Tail—2 pieces, 1/16x1/4"—Balsa, hard.
4. Floats—3/32" square Balsa; 1/16x 1/8" fairing strips.
5. Struts — 2 pieces, 1/16x1/4x15" bamboo. Sheet Balsa, 1/32x2 1/2" for sections. Also, 1/16x2 1/2" for sections and cowling.
6. Fittings, piano wire, diameter .029.
7. Propeller—extra large block—1x 1 1/4x10"—soft Balsa.
8. Motor stick—3/16x5/16x20" long —Pine.

(*Continued on page* 182)

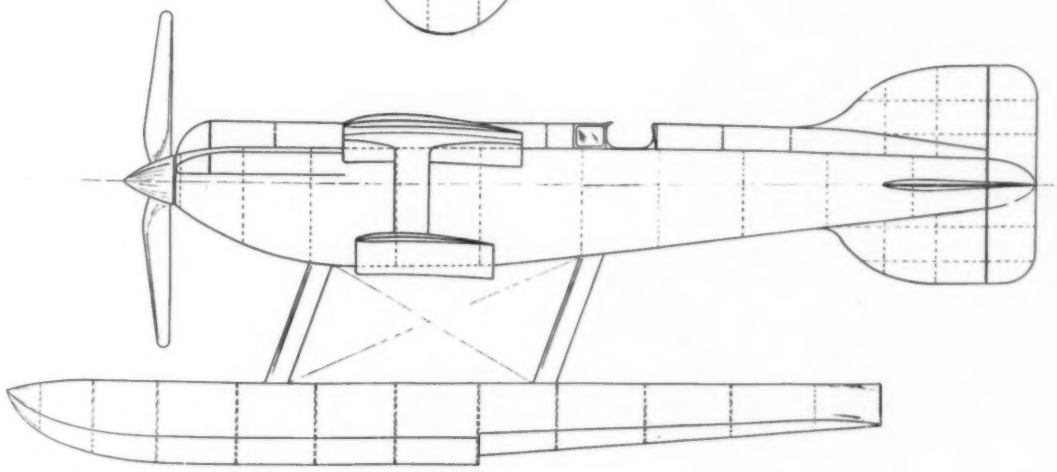
The Gloster IV. Seaplane

A Flying Scale Model



Note that both the span and chord of the top wing is greater than that of the lower wing, and that the top wing connects to the fuselage with a hooked or "wry" neck. The wings are only slightly staggered as indicated by dotted lines.

The seaplane floats are cigar shaped, tapering from front to rear with a sharp point at the rear. Great care must be taken to make both floats exactly alike so that the resistance will be equal.



Model Department

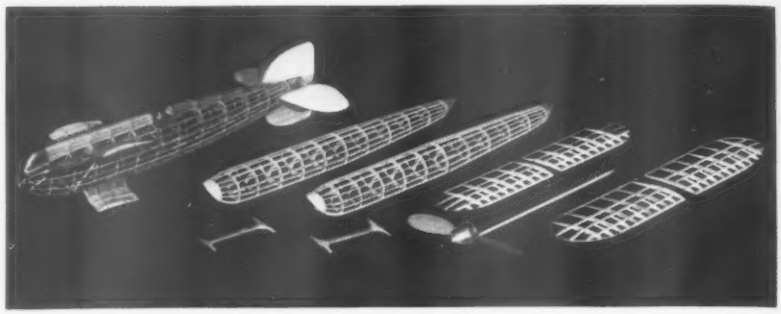
(*Continued from page* 180)

9. Spars—4 pieces—1/8x1/8x30".
10. Rubber motor — 20 ft. — 1/8", 30 gauge.
11. Entering edge — 2 pieces — 1/8x 1/8"—Balsa.
12. Trailing edge—3 pieces—1/16x1/4 x30"—Balsa.
13. Rib stock—Balsa 1/32" or 1/16" sheet stock, approx. 2x30".
14. Tissue — 3 pieces sheets 18x24", super fine. Mino tissue for floats.
15. Cement—1/2 oz. unit.
16. Lacquer—Black glossy for struts.
17. Lacquer—Red glossy and aluminum for propeller
18. Dope—small can.

DETAILED INSTRUCTIONS

Wings—No. 1

The ribs are cut out to the full size of the drawing as illustrated, either for the 30" or 15" model as desired. They may be cut out of thin sheet balsa one at a time with a razor blade or a thick block cut to shape on a band saw sliced off to the required thickness on a circular saw. Two sizes of ribs are required, one for the lower and one for the upper wing.



Framework of Wings, Hull and Floats.

The center section for the 30" model is six inches and this amount is left off of the entire span of the two top wing panels. Keep in mind that the panels are left and right when assembling the ribs to the spars and attaching the wing tips. The lower wings are attached to the center section in the lower side of the fuselage and the amount of space on the thirty inch model is only four inches, this amount being left away from the entire span of the lower wing.

Before proceeding with the entire assembly of the structure it is best to make simple full size sketches of the front view of the model.

Body—No. 2

The section of the body is oval, having the stream lining of the top cylinder bank from the nose to the rudder post. When building oval bodies it is very hard to line up the series of formers, as the correct shape of each one must be properly determined. In addition they must be exactly to the required size or the body will have high and low sections, longitudinally, also along the sides.

The simplest method is to build a standard square type body. Then adding a cowling effect around the entire unit. Note how the skeleton body is built, then parts may be added to form the oval sections and these in turn may be sanded out so that the entire shape conforms to a smooth surface when measured. Longitudinal fairing strips may be added at this time.

Rudder-Stabilizer—No. 3

Because of the extreme length of the body, it is very important that the weight of the entire tail section be as light as possible. The outside shape is bent of thin bamboo and the spars and ribs are of light balsa. The motor cowling at the nose is made of solid balsa and stream lined back into the center section of the ribs. The three bank type motor is employed in this plane.

Floats—No. 4

The main sections of the floats are smaller and may be cut from a solid piece of wood to the exact shape and then sliced off on a circular saw to the desired thickness, approximately 1/16 of an inch thick. The centers may be cut out to make these pieces lighter. The sections are all the same size and shape, no trouble should be encountered in fitting and keeping in shape the longitudinal members.

To the rear of the step there are four additional formers, each to a different size and shape. It is best to make the smallest one first and fit the others in only after a few of the longitudinal members have been put in place. The rear end is a solid piece of balsa hollowed. The front nose piece is made of a solid piece of balsa.

Covering—No. 5

Before covering the entire parts of the model it is best to check the points

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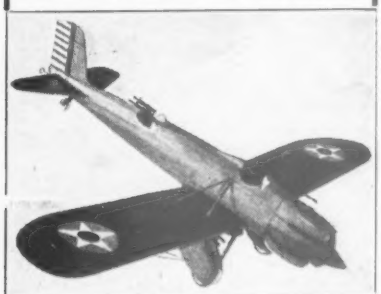

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at which the struts will enter the floats and body. At the points where the struts enter, strengthen the structure by cementing additional small pieces of balsa at those points. When the covering is completed on the individual items the whole plane should be assembled. The wings should have an angle of incident approximately 5/32 of an inch.

Assembly of Model—No. 6

The wings should be cemented to the center section and the dihedral angle should equal about one inch of height at the tips. Attach the lower wings in place and then fit the eye struts which are built up of balsa and the end parts should be cemented into the long member of the eye. The corners may be rounded away. Care should be exercised in fitting the eye struts correctly.

This part calls for a little patience and carefulness so that the angle of incidence is retained as required in both wings.

Propeller-Motor Stick—No. 7

Carving a propeller is not a very difficult operation, when one understands what shape the finished blade must have.

A low pitch will work better on scale models than a high pitch type. First mark an X across the full length of the block, then drill the center hole and make it only as large as a pin.

After marking the X, allow sufficient material along side of the shaft hole for the hub. Cut the remaining parts away and then carve. If the nose spinner is required, this is cemented on in sections and trimmed to a point. Where a long motor base becomes necessary it is difficult to insert it through the nose, make a larger one, and of balsa.

Shrinking-Covering—No. 8

After the entire model has been assembled, it should be sprayed with water. The spray should be very fine so that large blotches of water do not fall on one point, soaking into the wood, causing it to warp while drying.

Waterproofing Floats—No. 9

The floats have to be doped with two or three coats using a good grade of waterproof dope. Do not use dope that is too thick. It is best to apply two or three light coats evenly then one heavy coat unevenly.

Ordinary dope is not waterproof and care should be exercised in securing dope that is. Large planes after they are doped are given two or three coats of varnish. This makes them waterproof, not the dope itself. However, a good grade of dope will make the floats sufficiently waterproof.

Flying—No. 10

To balance the model for flying it will be necessary to have small weights at the front. This is best done by cementing small pieces of lead to the tip of the floats. The farther forward the weights are added the smaller they may be and the float in this place offers the most logical position. Numerous trials should be made and the model balanced perfectly before flying. When the model is balanced it should have a steady glide when released from the hand without any interruptions, and travel forward on a downward angle continuously until it lands.

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1/16 x 1	.04	8 for .30
3/32 x 3/32	.02	6 for .10
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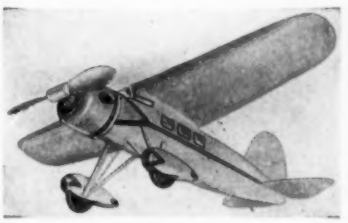

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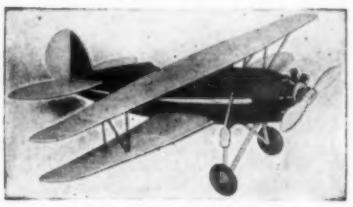

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WOMEN'S ACTIVITIES
Edited by Lady Mary Heath

Ruth Nichols, who holds three world's records for women, is making preparations for the building of a ship to be used on flights this spring. She is now doing some flying and working on the Unemployment Fund.

Lady Mary Heath.

Miss Nichols recently took out a permit to carry a gun, feeling that on flights through wild sections of the country, a gun would be of use in case of accidents. Miss Nichols believes Mrs. Stanford might have been saved if she had carried a gun to fire to summon help.

* * *

A number of women pilots accompanied the cruise of the United States Amateur Air Pilot's Association which flew from the Aviation Country Club at Long Island to Miami for the annual All-American Air Races.

Among the women pilots who made the cruise were Mrs. Betty Huyler Gillies, Mrs. H. G. Silleck, Mrs. K. E. Bauer, Miss Jessamine Goddard, Mrs Evelyn de Seversky, Miss Virginia Odell, and Mrs. John T. Remey. Mrs. Remey made one of the best flights, being the only woman who reached the races unassisted by a professional navigator.

Two races for women pilots were features of the final program. Miss Helen Fitzgerald of Binghamton, N. Y., won the Hialeah Trophy, averaging 138.932 miles an hour in a Gee Bee. Mrs. Lund was second in a Monocoupe and Rhoda Davis of Lansing Michigan in a Davis, was third.

Rhoda Davis, wife of Arthur Davis, who figured prominently in the contests for men, won the trophy. She averaged 123.86 m.p.h. in her Davis plane. Betty Lund was second and Helen Fitzgerald third.

* * *

Miss Paula Lund of New York, is one of the first women in the amateur air pilot's derby from New York, to reach Miami.

* * *

Completing an airplane trip around the world, Mr. and Mrs. Charles H. Day arrived at the Glen Martin Airport, Baltimore, on December 19. They had left the same airfield on April 28. They flew 15,000 miles in the eight months of their absence.

The trip was made in a small plane of Mr. Day's design powered by a Chevrolet motor. From Baltimore, Mr. and Mrs. Day flew to New York where the plane was crated and shipped to London. From London with Mr. and Mrs. Day alternating as pilots, they flew over Belgium, France, Germany, Bulgaria, Turkey, Syria, India and China. At Shanghai, the plane was shipped across to San Francisco, and from that city, the Days flew across the United States leisurely.

* * *

Edwin E. Kleinschmidt, Chicago, gave his wife a course in flying instruction for Christmas. Mr. and Mrs. Kleinschmidt recently joined the Edgewater Flying Club at the Chicago Airport. He has bought a Savoia-Marchetti and turned it over to the club to use. Both are learning to fly a training plane and will fly the amphibian when they graduate.

* * *

About forty Mexican women have taken flying instruction, but none have taken their license tests, writes S. Mary Williams (Lady Heath) from Mexico City, where she is spending the winter with her husband, Reginald Williams.

A government airplane has been put at the disposal of Mrs. Williams and her husband for the duration of their visit, and she is establishing a branch of the Women's International Aeronautical Association, with the assistance of the wife of the president, Her Excellency Senora Ortiz Rubio.

* * *

Mrs. Truxton Beale of Washington returned on December 28 to Washington, D. C., from Buenos Aires by airplane. Mrs. Beale flew first across the Andes Mountains, then north to Guatemala, where she visited the American Minister and Mrs. Sheldon Whitehouse. Then she flew to Merida, Yucatan, where she was the guest of the Carnegie Institute party, which is exploring Maya cities. From Yucatan she continued by air to Havana and Washington.

* * *

Miss Marjory Durant, daughter of William C. Durant, left New York recently on the Europa with her big Sikorsky amphibian, with plans for a 7,000 mile vacation flight.

Her route will take her from England to Cairo and then to Cape Town. She is taking Charles A. Lajotte as pilot and James L. Sanders as co-pilot. She takes the controls herself at times. The plane is fitted up with cots and comforts for traveling and is described as a flying houseboat.

* * *

Alice M. Richardson, the "flying grandmother" of Louisville, took her first lesson at the controls of the semi-dirigible "Puritan" at Miami on January 5. Mrs. Richardson plans further flights and says she is ambitious to fly the Atlantic. The Puritan has 112,000 cubic feet gas capacity.

Balloon Busting

(*Continued from page* 170)

morale of the enemy would be such as to materially decrease the number of attacks.

The possibility of the opposing forces also adopting this means of repelling attacks was also considered, but it was believed that a stabilized condition would be reached. Thus, with the Allies able to put a much larger number of balloons into the field, the measure would work to their eventual advantage. Experiments by both Allies and Germans, with explosives placed in the baskets of balloons and exploded by electric contact from the ground, had proved ineffective.

It fell to the lot of the 69th Balloon Company of the A. E. F., operating at the Bois de Nonsard, east of the Meuse River, to carry out the experiment.

The plan was approved by the First Army Chief of Air Service, but because of conditions during the St. Mihiel and Argonne offensives, it was deferred until more favorable conditions prevailed. When the Second Army was formed, a balloon and the necessary materials were obtained and shipped to that Army, and on November 8 it was made ready for use. The balloon was inflated with 20,000 cubic feet of hydrogen and 9,000 cubic feet of oxygen.

Because of the danger of a premature explosion, unusual care was taken in the inflation. The balloon was held to the ground with ground anchors through which the manouvering ropes were threaded after being lengthened to 100 meters. This made it possible for the manouvering squad to remain at a safe distance during the operation of inflating it. Because of the danger from static this operation was carried out only on damp days.

BUT the plan was not destined to be carried out, for on November 9, 10, and 11, the visibility was such that balloon operations were impossible. It was decided, however, to determine the effectiveness of the measure, despite the signing of the Armistice, and on November 12, it was sent aloft.

Commenting on the result, Major John H. Jouett, Commander of Army Balloons of the Second Army, reported:

"Three incendiary bullets were fired at it from a machine gun on the ground and apparently the first shot took effect. The balloon exploded with a blinding flash and a heavy detonation. The explosive force, however, was not greatly felt on the ground. Complete combustion appeared to have taken place for practically nothing fell to the ground.

A few very small pieces of charred fabric seemed to float down, but in all, these pieces would have hardly made a handful. No trace of the valve could be found. No trace of the traction cables nor the junction piece could be found.

"It would appear from the results of

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the explosion that the force extended upward, and it is the belief of those who saw the explosion that no airplane could have approached safely within a radius of 100 meters of the balloon. It appears to be a highly desirable method of checking enemy airplane activity against balloons, and if the opportunity should present itself in the future, it should be tried out on several fronts.

"There is only one point which cannot be cleared up until it is actually tried out against an airplane and that is the rapidity of combustion. If the balloon were fired at with incendiary bullets by an airplane 200 meters away, it is not thought that the airplane would be damaged, but it is thought that the moral effect would be so great as to deter further attacks on balloons."

END

Radio Bomber

(*Continued from page* 168)

plosion destroys everything within several hundred feet.

THE reasons for this type of warfare are obvious. The large guns, the "Big Bertha" and the like, are very expensive, are hard to move about, the accuracy is low and the life of the gun is very short. Some other method must be used for long distance action with high explosives. The use of bombing planes is rather limited, and because they are comparatively slow they are subject to being shot down by the enemy. They are not very effective for distances over one hundred miles. Nevertheless, planes are the only units that will travel through the air for long distances accurately.

After a plane has been used for war purposes for a comparatively short time, it is so badly worn out that it is not safe to trust with a man's life. Such planes would be more dangerous than the enemy. It is fatal to the morale of a flying unit if the planes cannot be relied upon. In the last war such planes were junked.

During the last few years, radio has been developed to the point where it can be used to make these useless planes valuable for long distance shelling, or bombing, if you prefer. During the last few years various vehicles have been controlled by radio and recently airplanes have been managed in the same way. There are two methods of controlling the flight. One by impulses that will change the direction at will, and the other by the use of a radio beam that would be pointed on the target and the ship following the beam. In the latter use a spy would have a new value. Instead of obtaining information about the actions of the enemy, he would have instruments that would detect the radio beam as it was being pointed on the target and act as an aiming point. His signals would inform the radio operator when the beam was properly pointed. The beam would be held steadily causing the plane to fly in a straight course against the target. The airplane would have another advantage over a projectile in that it could have an automatic radio aboard that would send information back to the operator giving its exact location at all

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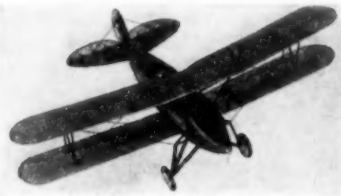

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times. This would sound in the earphones as a humming noise.

The most dangerous part of flying one of these bombers is the takeoff. A catapult would solve the problem. Catapults have been developed to the point where they can be relied upon to provide a safe and sure means of starting the ship on its way.

A ship of this sort would carry so much explosive that if anything went wrong and the plane fell short of the target, landing before entering the enemy lines, many men would be killed by their own weapons. To prevent this, small propellers are mounted on the fuse caps, to screw them down on to the detonator. These screws would be adjusted so that the plane would have to fly several miles, or until it was safely in enemy territory before the contact could be made between the fuse and the detonator, thereby insuring safety from that danger.

In order that the plane would have sufficient force to penetrate to the middle of the target, to create the greatest possible havoc, small charges of explosive attached to the wings would be discharged, removing them. This is controlled by the radio man at the base, the plane having informed him as to its location by the automatic radio.

With the wings removed and the plane at an altitude of several thousand feet, the fuselage with the motor still roaring becomes an enormous bomb, and diving at the earth at a speed of many miles an hour. This speed would be sufficient to penetrate the roof of any shelter the enemy could provide. Delayed fuses would be used so that the explosion would not take place before the plane got into a position where it could do the greatest damage, namely the center of the building, fortification or what ever the target was.

An excellent explosive is tri-nitro-toluene. This explosive is rather stable and if the plane should fall before entering the enemy lines, there would be little danger of premature explosion due to the concussion. Furthermore, T.N.T., as it is commonly called, forms a very black dense smoke when exploded. From the amount used, say 1500 pounds or more, this smoke cloud could be seen by an observer in an aeroplane many miles away, and he would report to headquarters, by radio, the effect of the explosion.

A charge of T.N.T. of this size would be able to do unbelievable damage. It has been estimated that fifty pounds is sufficient to raze the Tribune Tower in Chicage to a heap of brick and stone, at the same time destroying all the adjacent buildings. All humans within three hundred yards would be killed by the concussion alone. Since these planes carry 1500 pounds, multiply this damage by thirty and some idea of the destruction by one plane may be imagined.

In order that no part of the plane remains to be of value to the enemy, small charges of dynamite placed around the engine and radio apparatus insures its destruction.

The ideas that are presented here are not fiction; they are fact. It has been proven that an airplane can be used as a flying bomb. That is the basic idea. The other factors that enter are well known to be true. There is no doubt that long range fire of 500 miles by this means will be an important factor in the next war.

END

Flying in Europe

(*Continued from page* 150)

seilles were treated to a loop-the-loop performed under and over their favorite suspension bridge and with this farewell the boys toured on to Nice. From Nice to Milano an international Border is crossed. Here was gained some experience later to become valuable.

To avoid crossing the frontier with its complications, Ross headed out to sea fifteen miles, then came inland and set down at Milano. Immediately, a soldier rushed out and chased them off the field, saying that this was a military reservation and that the civilian field was in another part of town. Landed at the civilian quarters a guard took charge of the plane—unobtrusively.

Until Ross realized that the burly Italian following his every move was a guard, he did not know he was under arrest. When he had landed, the first question was, "Where did you come from?" The answer was Nice. "Ah, then you have crossed the border, violating rules number 1 to 1963, book 3, section 8A," and so on.

No, they had come by sea. "Aha," and much more whispering among the officials. "Well, there will be a slight delay." And while the guard tagged around, every telephone between Milano and Nice was rung to learn if the fliers had passed by. Meanwhile, a corps of engineers with tape measures were going over every inch of the plane—getting all the details. Every compartment was searched and even the propellor tapped with hammers.

NOT convinced, but without evidence, the plane was finally cleared for further flight after permission had tardily been received from Rome. On then to Venice and Trieste.

The next stop was to be Vienna, but in crossing the Alps the instruments failed to function and Ross turned back. Inspection proved that they had been tampered with seriously. Ross accused the Italians, who promptly declared the work to be the machinations of Jugo-Slavian spies. Later on, landing in Austria, the officials there solemnly stated that the Italian spies had done the horrid deed. With the instruments finally in working order, the flight was resumed and with Vienna covered, Berlin was next in view.

Without permission to land in Germany, they came into Templehoff and the plane was promptly seized. Not speaking German, the argument was at a standstill until a pilot of the Dutch K-L-M airways stepped into the fray, and speaking English, offered to help the boys out of their jamb.

The Dutch pilot was in Berlin only fifty minutes each day on his run from Rotterdam, and consequently could do little at a time. However, after four days of his fifty minute treatments, the fliers were permitted to work on their plan. A deep dyed conspiracy was laid.

Everett Van Dyke, the Dutch pilot, was a regular fellow. He later flew the Atlantic with Kingsford-Smith. He offered to allow the boys to follow him to Rotterdam where officialdom was less particular—if they could get away. Four days of combatting stern Germans had made the fliers desperate.

The hangar, in which the plane was locked up, was so huge that Ross calculated that if he could get his motor going inside, he might fly right out the door. The next day it was raining hard. But they stowed away their suitcase and with a great pretense of greasing the rocker arms made ready for a get away.

THEY explained, that after the rocker-arms were greased, it was necessary to run the motor to warm up and work in the grease. Officials agreed to let them run the motor for this purpose. With the J-5 turning over nicely, they awaited an opportunity, meanwhile making pretensions of hard labor.

Then, someone carelessly opened the door to permit another plane to enter. In a flash, Ross and Chet were in the cockpits, the motor roared under full throttle, and, before the startled officials could move, the plane was off the hangar floor and flying through the doorway. That was goodbye to Germany.

Fortunately, it was about time for the take-off of the Dutch plane and the flyers circled the field until they saw it streaking away toward Rotterdam and then Ross hung on its tail. Again, they had no permission to land. However, at the Rotterdam field, the first individual to greet them was L. M. I. Redley, a sport flyer, member of the Rotterdam Aero Club and formerly a student at the University of Southern California.

That was just like coming home, and Redley arranged everything. By taxiing between Rotterdam and Amsterdam, temporary police visas good for ten days were secured in each city and the stay could be indefinite. However, the boys were cautioned not to fly more than an hour in a straight-line as they would then be out of Holland and out of the jurisdiction of the friendly Dutch.

WHILE at Rotterdam, Ross participated in a flying meet of lightplanes with representatives from Eng-

(*Continued on page* 189)

XUM

Preparedness

(*Continued from page* 147)

pilots, would be ample to fill any wartime demand. And besides, why worry about building more warplanes when we already have hundreds of tri-motors, O. C.'s, lightplanes, etc., all in perfect flying order and ready to go?

Pure piffle—all of it. From my experience, the commercial transport pilot—representative of the type—is about the last man that I can think of who would be suitable for wartime activity. His training is all against that kind of flying, for accustomed to flying a well worn rut at a little over 100 m.p.h. or so, just how could he be expected to perform aerobatics in a combat ship? Flying a big bulky transport, hopping passengers or hopping the mail are as totally different from wartime flying as driving an ice wagon is different from the work of a jockey in the Kentucky Derby.

In time, this commercial pilot might work his hand into the game, but it would take just about as long as it would to break in some snappy venturesome young fellow who has nothing at all to unlearn. It would be difficult for me to imagine Bill Smith of the Eureka Airlines sitting in the cockpit of a pursuit ship.

Bill is an excellent pilot with a wonderful record for safe flying, and has about 10,000 air hours to his credit, covering more than 1,000,000 miles in this time. And no major accidents have been reported against him. But this means nothing at all in war where flash, snap and daring take the place of steady good judgment.

Bill Smith has too many fixed ideas soldered into his head. He has fought the controls of a big heavy loggy transport too long to catch on quickly to the delicate hair trigger control that is necessary when a ship is scooping them up at 250 m.p.h. and better. And most of the Bills I know have family ties and not a few of them are paying installments on bungalows.

Wartime flying is pre-eminently the young man's game. The World War taught us that lesson. It calls for perfect physical condition and great vitality. It calls for the love of adventure and daring that is lacking after a man passes his twenty-fifth year. In fact, it calls for everything that an old time transport pilot hasn't got, except for his knowledge of flying. Wartime flying calls for flaming youth—not for cautious deliberate age.

"Oh, yes," exclaims the standpatter, "then you musn't forget our Army Air Corps Reserves, a remarkably fine body of well trained men, trained to just this sort of flying."

Yes, we all remember the Air Corps Reserve that used to be. It started off with a big ambition and high ideals, but it has gradually dwindled out as the funds continued to diminish. And now, since all army expenses have been cut down to the bone, the members of the Air Corps Reserve get a few hours flying each year—under difficulties.

They do much better if they pay for their own flying time, and more than a few of these patriots have done just this. And, to get in the two weeks flying time necessary to keep their hand in the game, calls for a considerable amount of money out of their pockets—at a considerable sacrifice to most of them.

And here is just another fine example of governmental waste. After spending about ten thousand dollars per man on his training, which is a rough estimate of the cost to the Government, they are graduated—and then are practically ignored. Just why the Government should spend large sums for this preliminary training, and then begrudge the men two weeks practice each year, is difficult to understand. Two weeks each year is little enough to retain the "feel of the air," and yet how many of the men are actually getting in that time under proper flying conditions?

Conditions have become such that we must wake up and demand that our air forces be reorganized. Our national security demands that the United States Government supply a sufficiency of trained men, a sufficiency of equipment and instructors to properly maintain this force. The whole machine, in short, must start functioning as a unit—in case of war—without hindrance or delay.

To this end, POPULAR AVIATION has, for several months, been advocating a new civilian reserve air corps to be built up of young civilians which is to be maintained by the Government. This idea has appeared in POPULAR AVIATION in past issues, and it is very gratifying to the publishers to receive the many letters from those who are in favor of this project. We believe that we have hit upon an idea that will at one time solve the problem of national security and promote the cause of aviation.

Although little was written on this subject in the last issue, the editorial staff and management of POPULAR AVIATION have been investigating the many complicated features that enter into the workings of this sort of movement.

And we are pleased to report that we are more strongly in favor of the project than before, believing it to be perfectly feasible and workable. However, this cannot be accomplished by POPULAR AVIATION alone, but calls for your support and your friend's support. In numbers lies strength, and this means that we must have thousands of signatures to our petition if we can ever hope to succeed.

In short, our plan is this. We advise that at least 10,000 young men and boys be selected each year from high-schools and colleges for this training after an examination as to their physical and mental qualifications.

After the proof of their eligibility, they are then promptly sent to the nearest Government or approved civilian flying school for their training. This is to be free of expense to the students. After training, each student is to be given at least two weeks practice flying each year so as to maintain contact with the subject.

Just as an example as to how this is to be carried out, we will select our hero, Tom Jones, a high-school student of St. Louis, Mo. Tom has been an aviation fan as long as he can remember, has built and flown multitudes of models and is now a member of a local gliding club.

Pausing at the bulletin board one morning on his way to class, he sees a notice that instantly claims his attention. It is an official notice carrying the Government heading and states that all boys and young men between the ages of 15 and 25 years of age, interested in aviation, can receive full military flight training under Government supervision without cost. The applicant is then referred to the address at which the entrance examinations will be held, and is given a short sketch of the requirements for qualifications.

Full of enthusiasm, for Tom has long yearned for the flight training that his pocket-book prohibited, Tom presents himself for examination at the address indicated on the notice. He is met by the surgeon in charge who then turns him over to an assistant for a rigorous examination of his physical condition. After various peculiar antics in the laboratory, Tom's heart quickens as he receives the official document with the word "ACCEPTED" stamped across the outer page. He had hoped and hoped but now his best hopes were realized—at least in part.

From the laboratory, Tom was then guided into a typical classroom where he was examined on the subjects required by his classification. Some mathematics, elementary physics, elements of chemistry and allied subjects pertaining to aviation. After two hours in this examination, where he also is subjected to the quizz, his document receives the second approval stamp, the final password to the Government training course that is his highest ambition.

"Go home young man, and you will hear from us in about two weeks. It is likely that you will be given your assignment at the same time. Your physical and mental records are quite creditable."

And it seemed a long two weeks until Tom received an official looking document, which when opened, gave him his choice of the Government field in that locality or the nearest approved civilian school in that zone—Parks Air College. Knowing that he would have more freedom at the civilian school, where the discipline would not be so strict, he chose the Parks College and presented his credentials at this school early the following morning.

As with other students, Tom first attended the ground school classes where he was taught the underlying prin-

ciples of aviation together with a considerable amount of instruction in the shops, both on motor and airplane repairs and maintenance. Finishing this work, he was assigned to an instructor and given his first flying lesson.

From this time on, matters progressed rapidly until he had completed the fifty hours required for his Certificate and graduation. He was now a reserve pilot, entitled to two weeks practice flying each year at any field that he might elect. It was a grand and glorious way to get flight training —training that might later be used in the service of his country. The Government had gained a good pilot, and Tom in turn had gained the ambition of his life—the ability to fly, and to fly under the best instruction system known to the long experience of the Army Air Corps.

And now we urge you to pledge your assistance to this cause. We have done with words—now for action. Sign the petition and have your friends sign it with you. Then mail the petition to us. Further, write to your senator and congressman asking them not to appropriate one cent for extravagances such as the construction of $100,000 bombers. This is a matter of vital importance for everyone concerned and every delay in receiving your petition means just that much delay in gaining government support.

We have only to look at France, Italy, or any other European country for that matter, to understand the meaning of intensified reserve training. Not that we advise the stringent regulations practiced in France—not a bit of it—but it is an interesting example of what can be done with civilians in peace-time.

If France sees the necessity of maintaining an effective civilian air reserve corps, and if Italy views the matter in the same light, then it is at once evident that the same principle applies in this country. Italy has carried civilian training to the point that she has extended the training to young women as well as to men.

END.

Engines

(*Continued from page* 162)

arrangements have frequently disappeared and reappeared because in all aircraft engine design no one feature stands by itself. Manly's engine was a five cylinder radial and it ran beautifully. Anzani and Robert Esnault Peltrie had some success from 1909 and beyond with radial air-cooled engines.

But during the war only one such radial engine was successful, the Salmson, and after the war the static radial almost completely disappeared. Its revival was due to some very simple discoveries on the part of a few competent engineers relieved from wartime strain in their experimentation. The ascendency of the familiar Whirlwind type, from 1925 to 1931 is probably due as much to chance as was the ascendency of the six cylinder in-line water-cooled engine at an earlier period.

While the early tandem engines were meeting the problem of weight reduction through the use of lighter materials, inventors of many countries produced a large crop of radial and fan shaped engines, many of which were air cooled. There is a close relationship between the two, for the fan type is simply an imperfect conception of the radial idea.

If a radial is a wheel-hub, with spokes all around, the fan type is the same wheel-hub with several successive spokes missing. In the earlier models, the development of the fan type was doubtless due to the influence of conventional fan type motorcycle engines.

Meanwhile, water-cooling was actually giving the results that were imperfectly obtained in air-cooled engines. With the limitations imposed by poor metals, and a relative lack of understanding about air-cooling, radials were not very successful.

Soon it was discovered, however, that rotating the cylinders about the crankshaft achieved adequate cooling. And with the war came the heyday of the rotary air-cooled engines, many of which performed valorous service over the Western Front. Most famous of these were the Gnome, the Clerget and the British Bentley Rotaries, which actually developed more than 200 h.p.

THOUGH popular, the rotaries could not last long against constant improvements in the design of static radials and efficient water-cooled tandem engines. This change was forecast by the excessive oil consumption of the rotaries, inherent distribution difficulties, interference with pushrod action and the enormous power waste due to whirling the cylinders around through the air.

Now, another influence began to make itself known. A Swiss engineer, M. Marc Birkig, who had done most of his work in Spain and France, pioneered a new school of engine design with a tandem cylinder arrangement and water-cooling, but also with many novel features in detail. Notable among these details were the casting of all the cylinders in each row in one *aluminum* block, giving a continuous aluminum water-jacket which was lighter and better than the built-up steel jackets then in use.

But more important still, it gave a cylinder assembly unit with inherent stiffness of its own. Formerly, in tandem engines, each cylinder was at times subjected to excessive strains. A great many new features of detail design were incorporated in the newer engines, all of which were included in the new Hispano 2,200 r.p.m. engine far and away the best on the market at that time.

During later war years and the early post war years, when the tandem water-cooled types seemed to dominate the field, there were a few obscure engineers who had not forsaken their belief in the appropriateness of air-cooling for airplane engines. The first of the new air-cooled radials produced by this school were the A. B. C., the Cosmos (later known as the Bristol) engines in England, and the Wright R-1 and R-2 in the United States.

A little later, the Armstrong Siddeley series appeared in England, all of which were more or less superceded by the Lawrance air-cooled engines which developed into the Wright J series and the Pratt and Whitney "Wasp" and "Hornet" models. But during all this time there was little commercial activity in aviation, for the war had drained governmental treasuries and civil aerial transportation was just beginning to gain a foothold.

The air-cooled static radial engine gained headway slowly. Circumstances not altogether connected with the design of the engine gave initial success to the British "Jupiter" engine. It was not long, however, before the Armstrong-Siddeley and Lawrance products won recognition. When the Lawrance interests merged with the Wright Company in 1923, air-cooling took a tremendous leap in the United States, and from that date until the end of 1926, the Lawrance engine under the new name of "Wright Whirlwind" jumped into prominence as one of the most advanced engines of the time.

NATURALLY, with the awakening of public interest in 1927 due to long distance and endurance flights, air-cooled engines attained world eminence. This despite the fact that excellent block type water-cooled tandem engines were making impressive showings. But designers of radials were not forgetting that large frontal area was aerodynamically undesirable, and research was carried on as never before.

Many "in-line" air-cooled engines soon made their appearance, more or less successfully. Looking forward, the writer can easily visualize the radial tandem type with twenty and even twenty-eight cylinders. There is, after all, nothing extraordinary about this idea, which can be regarded simply as either five or seven-cylinder four-in-line engines grouped radially around a crankcase. Or, as four seven-cylinder radials, placed one behind the other and working on a four throw crankshaft.

Such an engine would constitute an effective compromise between the desired small diameter and short length. The "X" type engine is essentially this engine in its simpler form, but it has yet to be built and flown successfully, in this country.

The trend which is apparent during the entire 28 years under consideration, but especially since the war, is the trend toward higher crankshaft speeds. Interfering as it does, with propeller efficiency and especially with the larger engines, this tendency has led to the development of fairly satisfactory reduction gearing by which the propeller can turn at one-half crankshaft speed.

END

XUM

Flying in Europe

(*Continued from page* 186)

land, France and Belgium. One of the feats was for the "Moths," and other folding-wing jobs, to circle the field and then land before a lath reproduction of a garage door. Fold the wings, go through the door and then take off again. Prizes were given for shortest time. After everyone else had tried, Ross flew through the door and carried it away into the sky, much to the delight of the spectators.

The friendships built at this meet stood the aerial tourists in good stead when they visited other countries. The Dutch flyers had an organization called the "Flying Gin Bottle" which gave parties at the expense of new members in cities never before visited by the club. Ross met them in Paris, on one of these sprees, and the next day Redley took off for Italy only to spin and crash in the Alps.

About the 9th of July, the boys bid Rotterdam a reluctant farewell and flew on to Antwerp where they met the King of Belgium and demonstrated American flying for him. Then back to Paris.

Trying to locate someone in Paris who knew how to service Wright motors, they ran across F. A. Wolfgang who had been sent to Europe to look after Wright repairs and was so glad to hear a word of American that he almost embraced the familiar J-5.

In September, the tour extended to London and then back to Belgium where they flew low over Antwerp, Ghent and Brussels, distributing handbills for a meet of the Antwerp Aero Club. Meanwhile word had come that John Pratt of Los Angeles was visiting the German glider schools, absorbing the intricacies of the new art.

NEAR Dijons, a terrific storm came up just as the plane was being set down on the field. A gust of wind turned the plane over on its back, picked it up again and then turned it over completely, washing it out entirely. Soldiers rushed from the encampment to offer aid, and another wind gust ripped the metal roof from a hangar, threw it down upon them and injured several.

As this was a military field, formality decreed that the military staff could not touch the wreckage of a civilian plane. And civilian fliers must not remove a plane from a military field. What appeared to be an impassé was solved when a friend suggested a favorite French method of getting things done.

A lady friend of the boy friend was commissioned to work upon the susceptibilities of the military commander —for a price. Her charms must have been potent for a few days later, not only was the plane swept up by the military but also a freight car was provided to remove the debris to Havre.

Ross had planned to save only the instruments and engine as the balance of the plane looked hopeless. But again rules and regulations intervened. The plane was admitted duty free in one piece and must go out the same way or a duty of 78% of the value would be assessed. So the entire wreck was returned to San Pedro, California, and the tourists took the first boat home.

END

Aqua Gliding

(*Continued from page* 158)

at the start and have the towing boat start as quickly as possible.

This, I thought, would force the tail down, and naturally raise the nose up, before the pontoons had a chance to get any ideas. So we headed off, at a nice rate of speed—toward Canada. The pontoons, to my relief, did not dive.

The pontoons threw up a large amount of spray, as they plowed along, but I didn't mind particularly, as I had prepared for any emergency by wearing nothing but a pair of coveralls. When I thought we had gained enough speed, I gave a little pull back on the stick. Immediately I had the same sensation as flying, although I realized that I was just "on the step"—that is, still on the water but planing nicely.

I pulled back a little more, but did not take-off, so I pulled clear back with the same result. I tried this several times, but the stubborn pontoons still maintained their hold. Then I tried rocking with the ailerons to get them off one at a time. This seemed to work better, except that the low pontoon would drag a great deal and I had to counteract its turning effect with the rudder.

As it was, the glider dodged back and forth. It was dangerously near the edge of the boat's wake, which formed two big waves, one on each side of me. I had some success in getting off, however. Evidently the seven-foot length of shock cord was an unfortunate idea, for it would stretch out just far enough to get the glider off the water and then, suddenly losing its tension, would permit the glider to settle down again.

During one of the periods of planing on the water, the glider suddenly swerved to the left. I couldn't understand this, but I kicked right rudder. There was no result. The big wake-wave was just ahead, so I cut loose from the tow-line and reached for the safety belt. The left pontoon was completely out of sight and so was about

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half of the left wing panel. Lake Erie had also invaded the seat, so I unfastened the safety belt, stood up in the seat and dove off to relieve the glider of my weight.

The Cris-Craft was heading toward me and so was a large cruiser, blowing a whistle. The cruiser stopped for a moment, saw that I was all right and then went on toward Cleveland. This made the people on shore think that they were taking me to a hospital, or a morgue, or wherever they take drowned people.

I climbed aboard the speed boat, after retrieving the identification number which the Department of Commerce had very thoughtfully made buoyant, and we towed the somewhat soggy debris to shore. On the way back, I located the cause of the trouble —a five-gallon can almost completely submerged. So it wasn't my fault at all. I blame it on one of those Canadian bootleggers. I'm not exactly a wet, but it's easy to see that prohibition does have its disadvantages.

For those who would try the exhilarating sport of aqua-gliding (I intend to try again next summer) I have some advice.

Be sure the wing has a good angle of incidence.

Use cable instead of rope for towing, for the rope has a great amount of resistance when pulled through the water.

Omit all shock-cord and fly on a day when there is some wind.

Have as few persons as possible in the boat—they cut down on the speed.

Look out for obstructions, for a very small object may wreck a pontoon when traveling at this speed.

Have a quick release safety belt and a bathing suit for the test flight.

END

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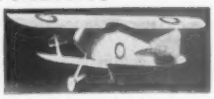

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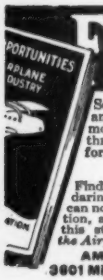

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Instrument Board

(*Continued from page* 155)

The supports of the rotor are connected to a small index needle in such a fashion that when the ship is turned horizontally to the right or to the left, the needle will indicate the direction in which the ship is turned.

THE altimeter, also a very essential instrument, has not altered greatly from its original form. It is simply an aneroid barometer, graduated to read in feet of altitude instead of the corresponding barometric pressure. It consists of a frame, inside of which is mounted an evacuated chamber. This chamber expands when the air pressure on its surface decreases, and this occurs when the instrument is carried higher into the air. This expansion actuates a small gear chain which in turn moves an indicating hand. The instrument is entirely self contained.

It is generally set at zero before beginning a flight, and will therefore indicate the change in altitude between any other position of the ship or from the altitude at which the flight was begun.

The rate-of-climb indicator is very similar to the altimeter, except that it is provided with an expansion chamber from which the air has not been exhausted. In this chamber is a tiny hole through which air escapes at a predetermined rate. Thus, instead of altitude, the rate of change of altitude is indicated by accumulated pressures in the instrument which have not been relieved by the hole.

The air-speed indicator is based upon a principle similar, in some respects, to that of these last two instruments. Two separate chambers are provided, with a thin diaphragm between them which is connected with an indicating needle by a gear chain. Two tubes are connected to the instrument—one to either chamber.

One of these tubes, called the pitot tube, is open at one end, and is subjected to the pressure of the on-rushing air. The other, called the static tube, is closed at the end, but in the sides of the tube, near the end, are punched a number of tiny holes. This is subjected, therefore, not to the pressure of the onrushing air, but simply to the pressure of the atmosphere. The difference between these two pressures is the measure of the air-speed of the ship. (See Questions and Answers Department in February issue.)

THE tachometer was one of the earliest instruments developed. Several forms are used. The centrifugal type consists of a small flyball governor which is rotated by a flexible shaft connected to the crankshaft of the motor. As the speed of the motor changes the balls in the governor move up and down, and this vertical movement actuates an indicating needle.

The pressure type, less frequently used, consists of a small rotating pump, whose connecting rod is attached to the crankshaft of the motor. The indicator is simply a pressure gauge of the Bourdon tube type. The speed of the motor is measured by the pressure produced by the pump. Another type has for the actuating device a small generator with an armature connected to the crankshaft. The indicator is a sensitive voltmeter connected to the generator.

The tachometer is generally the first instrument to give an indication of motor trouble. Even before the ear can detect a miss, the needle of the tachometer has indicated a decreased speed of rotation.

Perhaps the most recent and most valuable development among instruments is the invention of the Sperry artificial-horizon, which indicates the position of the wings in reference to the true horizon. Superficially, there does not appear to be a great deal to this instrument, but behind the face of the instrument is an intricate mechanism. The instrument appears in the illustration in the center of the instrument board and directly below the letters "N. A. T."

The face consists of a smooth background, blue on the upper half to represent the sky, which shades to a dark gray on the lower half to represent the earth's surface. Horizontally across the middle of this field is a straight bar of white which simulates the horizon. In front of this face, and in the center of the instrument, is mounted the small tail view of an airplane which is unmoving. This is also white, and luminous.

In the illustration, the airplane appears to be above the bar which it represents. This is actually the accurate position of the plane at rest, with level wings and with the longitudinal axis in a climbing position. In flight, and with this indication, the plane would be climbing with level wings. Should the plane begin to descend, the horizontal bar would rise until the small figure of the plane would be below it, in exactly the same fashion as the actual horizon would rise above the ship's wings.

NOW, if the ship is banked in either direction, the artificial horizon will

(*Continued on page* 192)

Promising Inventor

(*Continued from page* 158)

the pest is a fifteenth cousin of the fourth cousin of the grandfather of a congressman, must be as gentle with these insects as a mother with a new born babe.

ANOTHER example of this: Walter Parkin, chief something or other of the Department of Commerce, had an experience with a woman—not the first thought that comes into your head, gentle reader. This lady got into Mr. Parkin's office and planted herself in a chair, and Parkin listened to another invention.

This lady had an invention concerning autogiros. She conducted a hand laundry and she could see no earthly reason why clothing could not be tied to the windmills and dried. She presented several drawings of an autogiro, at least she said they were autogiros, illustrating just how this was to be done. Now when one realizes that it is not polite to laugh in anyone's face, the position Mr. Parkin was in is readliy understood. These drawings were just as clear as some of "Popeye's" English. The printing on the drawings which explained, or attempted to explain the draft was of the backward variety. The lady insisted that her plan was feasible. Four well known aeronautical engineers of the Department tried to show her how this would be impossible, but like all women she insisted on having the last word—in fact several hundred last words, while Mr. Parkin and the engineers listened in. All of one morning was wasted on this inventoress.

Amongst all this chaff now and then a kernel of wheat comes to light; just little kernels as yet, but still wheat. Several aids in the lines of paint, motors, and fabrics have had their share of assistance from Department inspectors, and the Department at large fully understands that some day "the big invention" will come to light, and they do not intend to be found sleeping.

Colonel Young, the chief of the Aeronautical Branch of the Department of Commerce, insists that extreme courtesy be shown to anyone entering a department office, be he, she, or it, crazy or otherwise. These orders make a diplomat a bashful little boy in comparison to a Department of Commerce inspector. There is no cure for these "pests" and like the above mentioned flies they will be with the Department.

The next time you see an inspector, examine him closely. If he has a glazed look in his eye, if his mouth twitches, and if he repeatedly opens and closes his mouth expelling nothing but air, then, gentle reader, you have met an inspector who has just had a session with an inventor.

The author thinks that Uncle Sam will have to endow a special coo-coo house for daffy inspectors. (A good many of us may think that several of them are coo-coo now.) We would also suggest a memorial to the wives of these same inspectors. After putting in several hours of this type of interviewing, we imagine an inspector would make a fit playmate for a couple of grizzly bears and a bob-cat, and if there were only one position open in the world and that was an inspector, I know one guy whose gravetone would bear the epitaph, "Died of Starvation."

END

Don't Miss This Issue

YOU WILL agree with us, that this issue of POPULAR AVIATION far surpasses any other issue in point of reader interest. Better stories, better illustrations and better make-up in general, distinguish the April issue. For your approval, we have selected the five following feature stories out of many:

1 First, of course, will be the second article discussing further, the all important problem of our National Air Defense. This article will be written by Walter W. Liggett, nationally known investigator and writer. A report will also be made on the progress of the POPULAR AVIATION PLAN for Free Civilian Training.

2 Lieut. Richardson has contributed an excellent article on the warplanes used in the World War, with many facts concerning their performance. This should appeal to our warplane fans and photo collectors alike, because the article is accompanied by some unusual photographs.

3 "When the Crash Siren Sounds," is a constructive story of intense interest. It describes the methods of handling crashes by the Army, and contains good practical instructions on handling the wounded in such cases.

4 We have been besieged, during the past few months, by readers who wish to find the center of gravity of their ships, either on existing ships or ships under construction. In this issue we have an article that describes two simple methods which are accurate and effective.

5 Do you thoroughly understand the inside workings of a wind-tunnel? Well, there is an excellent non-technical description of a small tunnel in this issue, with all of the details and methods of operation fully described. It shows how the model is suspended in the air-blast, and all about it.

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Chinese Airmen

(*Continued from page* 166)

list in aviation. A wealthy Chinese merchant of New York is defraying the cost of an intensive flying course at a certain Long Island airport for seven of his enthusiastic countrymen.

It does not require a great stretch of one's imagination to conjecture the possible outcome of a struggle in which, although no belligerent may possess a splendid land army and even a first-class navy, the other has finally attained the upper hand in the air. Cannot therefore a struggle between China and Japan prove or disprove for many years to come the true relationship of aviation to modern warfare? Will it take two Asiatic races, conflicting in such an out-of-the-way place as Manchuria, for instance, to say the last word in this much-debated subject? Will the skillful handling of its aviation army become a tower of strength to that party who erstwhile was so under-rated? Suceeding events can spell the answer.

Like all cats, to which he has so often been likened by his numerous friends, Bert Hall has nine lives—only a couple of which he lost track of in the Great War. For China, to whom he is a warm friend, he still has half a dozen to spare—if necessary. And, that is why he is affectionately and admiringly known as "General Chan."

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Instrument Board

(*Continued from page* 190)

continue parallel with the true horizon, but the small plane (since it is fixed) will move to the true angle with the horizon. The instrument will now indicate the precise position of the ship. The instrument will indicate banks up to 80 degrees (or very nearly vertical), and climbs or glides up to 45 degrees.

The Sperry artificial horizon is not more than four inches in diameter, and weighs about five pounds. Like the turn-indicator, the basic principle is that of a gyroscope, mounted like a compass in a set of gimbel rings. This gyroscope is attached to the moving face or the horizontal bar.

It is essential that the axis be maintained truly vertical at all times. Gravity must therefore be compelled to act upon the gyroscope to hold a true vertical. Usually, when gravity acts on such an instrument, a precession or movement to the right angle of the tilt is set up, and an oscillation is begun which would be fatal to this instrument.

Here, gravity is made to act indirectly so that the gyroscope moves from any tilted position directly to the vertical without passing through any period of oscillation.

The vacuum produced by a venturi tube causes air to be forced against the turbine bladed rotor, and gives it a speed of about ten thousand revolutions per minute. This air passes into the lower chamber. This is in the shape of a hemisphere. Hanging from the center point of this hemispherical chamber is a small pendulum of such length that it swings freely inside of the hemisphere with a very small clearance between the shell and itself.

THE air in this chamber exhausts at three equally spaced points on the hemisphere. Each orifice carries a tube with an elbow in it so that the air exhausts tangentially.

The pendulum covers an equal portion of the orifice when the axis of the gyro is vertical, hence the air reactions from all of the three ports are equal and will tend to neutralize themselves. If the gyro be tilted, the pendulum will close the port on the low side and open those on the high side, and the air reaction will be in consequence unbalanced. Thus, a torque will be created about the horizontal axis and any precession is towards the resultant gravity (or vertical) axis.

The lateral-inclinometer has already been mentioned. Another inclinometer is the fore-and-aft inclinometer, built on a like principle which shows whether the plane is climbing, flying level or descending.

Another instrument, with which every modern plane is equipped, is an accurate eight-day clock, differing in design from an ordinary timepiece by having four numerals, "1," "3," "6," and "9." The "1" appears at the place at which ordinarily "12" is found. At each of the other hours appears a small luminous dot instead of a numeral.

The arrangement of the instruments on the board in front of the pilot is far from being a matter of personal choice of beauty, design or even symmetry. The instrument board is much like the keyboard of a typewriter in that respect. The latter is arranged with certain letters conveniently grouped because they must be used more frequently than other letters. Letters which usually follow one another are placed so as to be struck with alternate hands for speed. Thus "Q" is placed at one end, and "U" at another for this reason. Moreover, all typewriter keyboards have been standardized. If a typist can use one typewriter successfully, without watching the keyboard, he can do the same on another.

The present instrument boards have been constructed on just such principles. The instruments whose purpose is related are found together. Those which have to do with the position of the plane are the important ones, and they occupy the central space where the pilot's eye falls upon them with the least effort.

In the cockpit illustrated, the stick-controlled ship, there are seven of these grouped together. At the top of the board is the floating magnetic compass. Directly below this is a large bank-indicator. On the row below appear the altimeter, the artificial horizon, and the rate of climb indicator. On the row beneath this are the air-speed indicator, the turn-and-bank indicator and the tachometer—which, while not exactly a position indicator, ranks with the others in importance.

END

Build Lightplane

(*Continued from page* 176)

at the hinges or at the trailing edges nearest the root end of the wing.

FUSELAGE CONSTRUCTION

AFTER you have purchased the tube or wood for the frame of the fuselage you should make a jig for constructing the sides and the top. After the pieces, struts, longerons, etc., have been cut to shape, they should be placed in the jig and fastened together in the same manner as shown on your plans. When the sides have been completed, they should be removed from the jig and the top parts fastened in place. Then the bracing should be put in place, the fuselage structure trued up and painted or lacquered.

After this has been done, the turtleback should be made and fastened in place, and the seat, control stick, rudder bar and the floor added. Then the instrument board, throttle and engine control rods are put in place. After all this has been done, the side fairing strips should be put in place and the wing struts made and attached.

TAIL ASSEMBLY

THE tail assembly, if of wood, is constructed in somewhat the same man-

(*Continued on page* 194)

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Build Lightplane

(*Continued from page* 192)

ner as the wing structure. If of metal, the members should be cut to shape with allowance made for expansion developed during welding, and fastened in a jig so that they will not move while being welded.

If the small tubing tends to bend while being welded, it can easily be made to come into line by the following:

First, heat the tube on the side of the bend to a dull red heat and allow it to cool. Don't be surprised if the bend increases, for this is exactly what it will do. Upon cooling the tube will almost always return to its original position. After all the welding is completed, the tubing should be painted, and then covered. Use no more than five coats of dope or the member will warp.

LANDING GEAR

THE landing gear on most lightships consists of steel struts with wire or aluminum wheels, and with shock-cord and pneumatic tires to take up the shocks of landing. Little need be mentioned about the construction of this part of the ship except a word or two of caution as regards the strength of this assembly.

The struts should be of sufficient size so that they will not fail under an extremely rough landing, and only the best of welders should be employed to weld up the tubing, for most failures in the landing gear are due to weak welds which part easily under strain.

CONTROLS AND RIGGING

USE nothing for the control cables and rigging except what is mentioned in the specifications of your ship. Wire or cable of smaller diameter is liable to fail under the strain. and then the motor is shifted either

Care should be taken in making the terminal connections with hard wire so that no scratches or cracks develop. In the case of cable, the ends must receive sufficient wrapping and soldering.

Control cables should be made of extra-flexible cable if run over pulleys, and of flexible stock if on a straight course. In all places where steel wire is used for bracing it should be tinned aircraft wire and not music, piano or hay wire. Hay wire or iron wire stretch like rubber when under tension and piano or music wire is liable to crystallize.

Care should also be taken to see that any cables running over pulleys cannot slip off and bind at the side of the pulley.

In rigging your ship, make sure that you rig it exactly as shown in the plans of your plane and as mentioned in the specifications. The correct manner of balancing your ship for flight is explained in a paragraph near the end of this article.

INSTALLATION OF ENGINE

THE mounting of the motor should be left till last so it may be moved a little to the front or rear to insure perfect balance. After the ship is balanced correctly, the motor cowling is made to fit. Be sure that the motorbed is firm and that the motor is bolted down tight. Also make sure that all connections from motor to the instruments are sound and do not leak oil at the points of attachment.

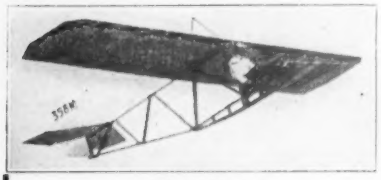
Instruments should have holes for their mountings cut out of the instrument board and then should be fastened firmly in place with small diameter bolts. The tachometer shaft housing should be installed so there are no sharp turns to impede the free rotation of the drive shaft.

All oil and gas lines should have a circular loop in them near the connections to prevent crystallization due to vibration. The throttle control rod should be installed so it does not bind, touch against any part of the ship, or stick if suddenly pushed forward or rearwards.

PREPARING FOR FLIGHT

IT is presumed you have completed all the parts of your ship and are now ready to assemble the plane. A triangular shaped piece of stock, about three inches on a side and with one side fastened to a strong saw-horse, is secured and a board is placed under the exact center of lift position on the plane. The complete plane, minus the wings, is placed on the horse with the center of lift position over the pointed portion of the horse.

The motor is, of course, not bolted down, and sandbags or an actual person of about the weight of the average pilot are placed in the seat. The plane is then moved backwards an inch from the original center position on the horse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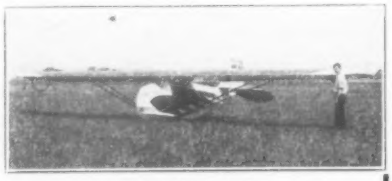
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END

Q & A

(*Continued from page* 172)

that you speak of is the "centripetal force." The centrifugal force is the equal and opposite force that resists the centripetal force, or in other words, is the resultant of the centripetal force.

Centripetal force arises from an elementary principle of dynamics, the fact that a force is required to change the direction of a moving body. "A body tends to move along a straight line unless acted upon by another force." Now, when a body, such as an airplane for example, swings around in a circle, it is constantly changing its direction and therefore requires the continuous application of a force to keep it in its circular path.

Contrary to the general opinion, a body travelling in a circle does not tend to fly straight out from the point of support along a radial line, but the centripetal force is tangent to the circle. It tends to continue its motion, if released, straight out along a line at right angles to the radius. This force is proportional to the velocity and inversely proportional to the radius of the circle, increasing when the speed is increased or the radius is decreased.

* * *

QUESTION:—Lester D. Fellows, Moline, Ill. *Please explain the meaning of several terms that I have picked up*

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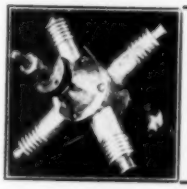

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from some aeronautical books. The first question is to inquire the meaning of "bending-moment," and also the meaning of "extreme fiber stress." Third, what is meant by "Section modulus" and "Poisson's ratio?"

Answer:—YOU have picked on some units that refer to the strength of materials and which are somewhat too complex for a detailed reply in these columns. However, we will attempt to give a shorthand description so far as possible in a few words.

To begin with, a bending-moment is the effort exerted in bending a beam. It is this effort, depending both upon the load and the length of the beam, that causes the beam to bend or sag under a load. The longer the beam or the heavier the load, the greater will be the bending moment. The moment is expressed in terms of "inch-pounds." The actual moment on any beam also depends upon the manner in which the beam is supported and upon the manner in which the load is distributed along the length of the beam.

When a beam is bent or subjected to a bending moment, one face of the beam, or the outer fibers, is placed in tension while the opposite outer fibers are in compression. The outermost fibers in a beam are most effective in resisting a load or stress, and at the exact center of the beam, there is neither compression nor tension—and hence no stress at all.

This is the reason why wing spars are generally arranged so that the greater part of the material will lie at the top and bottom of the spar, with as little as possible near the center of the beam. The "extreme fiber stress" is the load placed on the outer fibers by the bending moment.

The "section modulus," or the "measure of section," depends upon the shape and size of a beam section. Thus, by means of the section modulus we show the relative effectiveness of different beam sections and their dimensions. The beam may be rectangular section, an "I" beam section, etc., and the modulus takes these factors into consideration. The section modulus, multiplied by the extreme fiber stress, gives the resistance of the beam to bending in inch-pounds.

END

Practical Lessons

(*Continued from page* 178)

thrill out of the artificial horizon as the white band rose and fell in respect to the model. One model wing went down, and Bob quickly transferred his attention to the bank-and-turn indicator to see if Ed had her banked up properly for the turn. Fine as frog hair, the instrument detected no side-slip—either inner or outer.

He glanced at the altimeter just as the words came over the phones, "All right, take her over and fly due west for about five minutes, climbing from 2,000 to 3,000 feet. Then, after five minutes, turn north and keep on until I tell you to quit."

Bob took over the controls and seated himself comfortably to do a little real flying although he couldn't see where he was going. It was simple enough to keep her on an even keel by watching the artificial horizon, but then there were other things to watch—that first turn to the west for example.

He started the turn and banked for it, watching the artificial horizon, but he was quickly rewarded by a yell from Ed over the phones, "Say, you're in an inner side-slip—get her out—get her out!"

Bob pulled the controls back, but still the model wings held down. Then, down went the nose, and Ed yelled, "You're going to spin in a second if you don't pull her out. Have you forgotten about spins or what's the matter with you, anyway?"

Bob quickly applied the remedy for spins, but because of his new and confusing surroundings, only succeeded in tightening the spin. And then, Ed finally had to take over the stick until they were again on a normal flight path. This sort of flying takes quite a bit of practice, and is seldom accomplished the first time.

After the spin was straightened out, Ed spoke over the phones to Bob. "You watched the artificial horizon but you forgot everything else. The next time you make a turn, look at the bank-and-turn indicator.

"You made one fine inner side-slip on account of too much bank, and then you got rattled and put her into a dive, completing the job. And besides this, it's a wonder you didn't stall her, you were going so slow—give an eye to the air-speed meter—it's as important as any of the rest. All right, now go on."

Bob saw from the compass that he was streaking it northeast instead of west as Ed wished him to do, so he gave the rudder bar the works, gave her a little left stick for the bank, and then watched the bank-and-turn indicator. Perfect—by all the meters he could see—and just that one brought the grief. He was watching the horizon, the bank-and-turn and the compass, but he forgot the air-speed meter—and stalled her.

"Nose her down and touch the gun," roared Ed over the phones. "You're stalled. For Pete's sake, didn't you feel the controls go sloppy in your hands?"

Bob watched the horizon's dial, and nosed her down sharply, and watched the air-speed meter pick up while the needle on the altimeter was falling rapidly as he expected. Up to normal speed now—flatten her out again. Again the horizon told when she was flattened out, and then they proceeded in normal flight—due west according to the compass.

"I wish I had about two dozen pairs of eyes, thought Bob. It's about time I looked over the tachometer and the radiator temperature—and maybe the oil pressure to see how they are getting along. Oh, well, she's turning up 1,475 r.p.m., radiator temperature 160 deg. F., air-speed 105 m.p.h., altitude 750 feet and flying level."

"Now, Bob, try to turn south on a good sharp turn, and remember what you have to look for. Right rudder, right stick, watch the bank-and-turn, watch the compass and the air-speed meter. O.K., go to it."

Up she went on one wing, the model on the artificial horizon showed that the wing was steeply up. "Air-speed 95 m.p.h.—O.K. Bank-and-turn shows that the bank is not steep enough. That's easily fixed—and there she is. Now she is pointing south, according to the compass, and I'll straighten her out. Fine—that's the stuff—all the clocks are normal."

"Not so bad," quoth the critic in the front pit. "That last turn was a masterpiece except for a little chunk of it when you were not banked up enough. Not bad though, and as soon as you get practice in reading instruments without straining your eyes, we'll do a little bit of fancy navigating for some fixed point. You will soon find that your eyes and the feel of the wind in an open cockpit machine are simple things that take the place of a whole lot of instruments when you are flying blind.

"Well, I'll take her down and then we'll take a little joy ride next month with you flying blind for a town about 100 miles from here. If you can hit that burg, flying with instruments alone, and after making about half a dozen turns, then I'll say that you're pretty good."

END

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TRI-STATE COLLEGE

Airy Chat

(*Continued from page* 142)

Why could not Italy and France have done the same?

I should think that had England decided to wait it would have put her to a disadvantage. And then too, what engine has proved the equal of the Rolls-Royce engine? It is said that Italy set an official record greater than the best England did. There was no need for England to try and outdo herself with no competition. Again I ask why should England have waited for the other two entries? As for sportsmanship, England stands second to none.

I suppose that there is no legal or even ethical reason why England did not wait for the others. However, it rather seems to me that in view of the great amount of preparation necessary for an event of this sort, that a few days waiting would have been good sportsmanship. As I understand it, this was a race for seaplanes over a given course—not a production race.

* * *

AND now we come to the subject of this month's cover—with a story attached. This relates to the use of radio controlled robot bombing ships which are so likely to become a feature of the next war. True, they are prohibited by the Hague Tribunal and similar pseudo peace institutions, but then so was the use of poison gas and chemicals prior to the World War. If the necessity arise for them, they'll be used —Hague or no Hague.

* * *

WHO won the war? Well, we haven't decided yet, but Mr. McGrigor has turned up at last to fire a few shots into the enemy camp. Welcome to the battle zone, McGrigor—may the best man win.

You can hardly imagine my horror, when upon opening the January issue of P. A., I found in the "Airy Chat" section another letter on the Rickenbacker and Press Agent matter. This time it was from H. Kenneth Bostead, ex-Corporal, Gunner and Observer, 1st C. M. M. G. B.—present occupation unknown. Why, H. Kenneth, where have you been all these years?

I have a slight suspicion that Mr. Bostead would derive much pleasure in caressing my features with triple-heavy brass knuckles. But I'd pardon a former War Air Gunner such a trifle. In fact, I'd pardon him anything, including the loan of a nickel, if it weren't for the dirty way in which he tried to impress me and—yes, you too —Mr. Editor, with his excessive knowledge on aviation subjects. Especially on information concerning Capt. Brown.

I have much pleasure in stating frankly that my opinion on the Rickenbacker bugaboo has not changed.

We have always been admirers of Albert C. McGrigor, just as we admire any man who has the courage to stand up and say what he thinks regardless of what the masses think. That's the reason why we published his article in the first place.

* * *

AND now there is another challenge to the letter written by H. Kenneth Bostead. This letter is from Ian L. McKenzie, Allerton House, Chicago, who will meet with McGrigor's appreciation, I am sure. You have the floor, Mr. McKenzie.

With regard to Mr. H. Kenneth Bostead's letter, concerning the discussion of Col. Bishop, VC, DSO, DFC, etc. For his information, he enlisted at Barrie, Ontario, Canada, in August, 1914 as a non-commissioned officer in the Mississauga Horse, and went to

(*Continued on page* 198)

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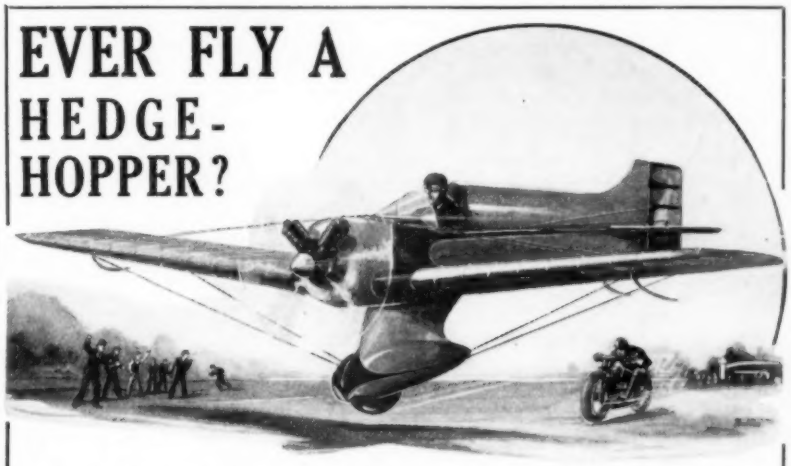

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Practical Mechanics

MAKE IT YOURSELF

JUST to give you an idea of the subjects that make up this first issue, we will select seven of the feature articles that are accompanied by one or more blue-prints or working drawings. These are: (1) How to Build a Hedge-Hopper; (2) Building and Operating a Simple Televisor; (3) A home-built "Electric-Eye;" (4) Making a D. C. Motor From the Scrap Pile; (5) Construction of a Class "B" Outboard Racing Boat; (6) How to Make a Colonial Bedstead, and (7) A Buzzer Radio Transmitter is Easy to Build. And then follows a list of shorter articles on all sorts of constructional and experimental subjects, interesting, copiously illustrated, and right up to the minute.

* * *

PRACTICAL MECHANICS is issued by the publishers of POPULAR AVIATION. We won't tell you about the price and size now—we wish to give you the surprise of your life on February 15, when it should blossom out on your favorite news stand. Tell your dealer to save a copy for you—it's well worth while.

* * *

SEE IT ON THE NEWS STANDS ABOUT FEB. 15

Airy Chat

(Continued from page 197)

Valcartier Camp, Quebec, with the 1st Canadian Division.

This unit afterwards became the Canadian Mounted Rifles, and at Salisbury plains, England, he applied for transfer to the royal flying corps, which was a British unit and not a Canadian unit. As a cavalryman, he was not spectacular. Apparently the shoe was on the wrong foot, but as soon as he was transferred to the R. F. C., he was a horse of another color, and the three B's of the 57th Squadron, BISHOP, BROWN, and BARKER showed them all a few things in Belgium.

This information I happen to know from personal experience, being there myself, and being very intimate with an old school chum of Bill Bishop's, I have met him personally.

The establishment of the Royal Canadian Air Force did not take place until 1919, *at Camp Borden, Ontario. Canada has a great deal to be proud of in her 1st Canadian division. A lot of them transferred to the R. F. C. and were among the leaders of them all.*

I'm going to get down to the bottom of this "Who's Brown" affair until I get all of the dope. At least we are learning a lot of air history, and that's something.

* * *

IF any of you intend to make a flying tour through Europe, I am sure that you will get a lot of information—and a lot of laughs—out of the article appearing in this issue. Being checked, by the experiences of others, this is an undoubtedly true article down to the last word. There are many things happening daily in Europe that we would not tolerate for one minute in the U. S.

* * *

FROM time to time, during this month, we have had many letters from readers who are greatly worried over the laws now being leveled against amateur aviation. To our ideas, there is altogether too much legislation on the subject of aircraft—laws and regulations that are putting the United States into the European "verboten" class. It will not be long until these regulations become so onerous that lightplane flying, and amateur aviation in general, will be entirely suppressed—the evident desire of many manufacturers.

Now, just let us put ourselves on record by making a statement regarding amateur activities. In all of the history of industry, it is the amateur who developed that industry and contributed most of the hard thinking and devising. The research departments of large corporations, headed by "Doctor this" and "Doctor that," may make many minor refinements, but they are entirely destitute of any original basic ideas. If anything radically new comes to the surface in the world of invention, 99 times out of 100 it comes from the amateur or "kitchen sink scientist." The others are hide-bound by tradition.

This was true of radio, it is true of the automobile and of television, just as it is of aviation. In proof, I will just name a few great amateurs who developed science "on their own time": Wright brothers, Marconi, Samuel Morse, Benjamin Franklin, Baird, Edison, Elbert Haynes, Duryea, Bessemer, Goodyear, etc., etc.

Do you think that we would have the present wonderful inventions in aviation, radio, telegraphy, general electricity, the automobile, commercial steel or rubber, if inventing had been closely regulated by laws and rules? No. The amateur rules in invention and discovery, and a backward step is taken every time that amateur activities are curtailed.

* * *

NOW let us read a letter on the subject of Government restriction by C. A. Clarson, Boscobel, Wis. This will interest our lightplane and glider fans, who are getting "all het up" over recent regulations.

I like your magazine a lot and hope all aviation editors will help the organization of aviation enthusiasts to abolish a lot of the unjust restrictions placed upon amateur flying.

Regulation of passenger and commercial flying and flying routes is, of course, necessary to the industry, but what the amateur wants to do "on his own" is nobody's business so long as he interferes with no one else.

He should be kept off commercial fields and routes, but if he wants to use somebody's cow pasture for his own experiments, and to develop his own ideas, nobody has any right to stop him, though they may have the power of the law to do so.

Keep up your lightplane stuff. If we get enough interested in this phase of flying, and get them properly organized, we may be able to promote some test cases to see if the old Constitution is really more than something to read in school.

I can't blame those already in the game for trying to make it expensive for the others to get in, since that expense accrues to them one way or another, but some aspects of their attempts are a little too much for a nation supposed to support personal liberty. It is up to the amateur to decide whether to fight those aspects or humbly submit to the indignity of being told what he must not do in his own backyard.

Attaboy. Go after 'em. I believe, as does Mr. Clarson, if the amateurs of aviation were organized against the piddle-paddle of nosey politicians, that the present oppressive measures could be successfully combatted. The fact remains, in spite of all the legislation controlling airplanes and pilots, that we still have accidents with the laws enforced. Airplanes built after government approved stress sheets still collapse and government licensed pilots still fail to come out of tail-spins.

* * *

SAY, fellows! Don't forget to sign that petition blank appearing in this issue, and get as many friends as possible to sign with you. You'll find it back on page something-or-other. The movement is well worth while.

* * *

LADY MARY HEATH, who is known to all of you through her "Women's Activities" column, has added new laurels to her brow. A recent letter from her states that she recently obtained a pilot's license in Mexico—and is the only woman to hold a license in that country. Fine—congratulations. But to cap the climax, Lady Mary has turned inventor and has taken out patents on two ideas that look very promising to us.

First is the retractible tail-skid which folds up under the fuselage when an electric button is pushed on the dash. By the reduction in air resistance afforded by this device, Lady Heath believes that she can add several more m.p.h. to the speed of the ship.

And next comes the invention of folding rotor vanes for an autogiro, these vanes adding to the speed of the

(Continued on page 200)

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Airy Chat

(*Continued from page* 198)

autogiro, which is still a comparatively slow ship. And this reminds us that Lady Heath was the first woman to fly an autogiro, the flight taking place way back in 1926.

* * *

WE have just received a letter from Hans Groenhoff, brother of the famous German glider pilot, Guenther Groenhoff, saying that the latter made the first non-stop flight in a tailless ship—the "Hans Huckebein." This was his own ship, in which he flew a distance of 230 miles in Germany.

* * *

WE have an ardent slotted wing enthusiast with us, Joseph Kotula, New York City. His letter indicates more than a passing knowledge of slotted wings and is therefore of much interest.

I read with keen interest an article in your publication, explaining the action of the wing slot as installed on the wing of an airplane, and the benefits derived from its use.

Perhaps the most important part of that article, to me, and to many others who read it, was a description of the flying characteristics of a certain slot-equipped ship in a slight wind . . . he said, "it climbed at an angle of about 45 degrees and with almost no forward motion."

I have an idea that he is speaking of the McDonnell "Doodlebug" at the Chicago Air Races.

There has been a lot of uncertainty about the value of the wing slot. Some eminent aeronautical engineers have even gone so far as to say it does not increase the angle of climb, or the landing angle . . . does not stay the stalling or burbling point. No doubt you have read the same as the writer on this subject.

After reading your very refreshing and encouraging article, I would like to see a "showdown" on this wing-slot question. Though you have been very kind to print so much good material on the subject, I am going to ask you to publish even more.

For one thing, I would like to read a very detailed description by the author of that article, of the performance and characteristics of the same slot-equipped ship he spoke of.

Could you publish some information on the flying speed-range of the Cornelius Free-Wing monoplane? That seems to be a step in the direction of the non-stalling ship from a different angle.

Yes, you are partly correct. It was the "Doodle Bug" that I had in mind at the time this story was written, and also two other experimental slotted wing ships of the same general order.

I am a firm believer in the possibilities of the slotted wing, and I hope to have much more material on this subject. No matter what is devised in aviation, there is always a group of self-appointed authorities that rise up and "knock" the venture, so this need not worry you much, because they are invariably on the wrong side of the fence.

* * *

THERE is a very interesting story on aviation engine development in this issue, made doubly interesting for the reason that engine history has always been more or less neglected. When you read this article, it may come as a surprise that the earliest practical aviation engine was a radial type designed by Manley for the Langley ship.

* * *

MORE good news for you fellows who like to build things and experiment. The publishers of POPULAR AVIATION are going to bring out a brand new magazine—*Practical Mechanics*—devoted to the subjects of amateur mechanics, chemistry, electricity, automobile maintenance and a hundred other mechanical and scientific subjects of interest to all of you.

We're mighty busy at the office, fixing up the first number, and we believe that it is going to be a knock-out—only magazine of its kind on the market. If you like POPULAR AVIATION you sure will like its little brother. Chock full of large size plans on nearly everything—and only 10c! Watch for it about Feb. 15th.

* * *

NOW, we can't refrain from picking another fine letter from the pile in which Joseph Gaizanskas, Chicago, Ill., lauds the free training movement. This is being printed because it reflects the attitude of boys toward the matter.

I think and I hope that this letter will convert all the readers of the POPULAR AVIATION.

In my opinion, I think the POPULAR AVIATION *has tried to aid the people and not only the people but the welfare of the United States.*

A group of us boys have studied all the modern war equipments and we think that what the POPULAR AVIATION *has printed in the December issue is perfectly correct.*

Now, I think that the sooner the readers and their friends would get out some sort of petition, so that one who is really interested in the welfare of the United States would sign it, it would help a great deal.

I am willing to organize a group of boys who are really interested or even combine them with some other organization.

Well, that's the idea. Get ambitious boys and men to become sufficiently interested in this air reserve to organize their friends and neighbors into groups for upholding the principles for which the reserve stands. This is going to take a lot of work—plenty for every-

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body—if it is to be a successful venture.

* * *

AS you have probably noticed, we have dropped our usual feature war story this time—just as a test. We wish to find out whether the majority of you are really interested in these war stories or whether they are becoming tedious. A great many have written in, saying that they had rather have a story on new and up-to-date aviation activities than to read about a war—long gone past. Now, the only way that we have of finding out what you like or don't like is to drop that feature for a time until we get letters on the subject. And that's just what we did in this case.

If you like the war stories, fine. We'll keep on running them. If you don't like them and had rather see some new material in their place—fine again. We had just as soon do the one as the other, but we wish to please our readers. So write in and tell us what you think about this matter so that we can determine what to do.

* * *

THERE has been a lot of discussion about the relative advance of aviation in the United States and Europe. This discussion, you will probably remember, was started by Ralph Pritchard some time ago. Then there was a reply to the Pritchard letter, and now we have Ralph back with us with a reply to a reply. Ralph claims that his opponent dodged the issue by confining his attention to commercial ships, while Ralph claimed that we were inferior to Europe only in the matter of military ships.

Well, this is a difficult matter to settle any way that you look at it, particularly with military ships, where all of the true dope is kept under lock and key for military reasons. Any statements in respect to military aircraft can hardly be more than a guess—at least so far as the civilian is concerned. True performance figures are not published by the government on recent issue ships. Least of all would I believe the imported baloney that comes to us from Europe.

* * *

HERE'S another idea brought to us by the pen of J. Wilbur Anthony, no address attached. He suggests that more attention be paid in this book to the development of mechanical motors for the propulsion of model airplanes. He was quite enthused over the model steam power plant described in a past issue of POPULAR AVIATION, and sees possibilities ahead for steam, compressed air and gasoline engines. He does not think that the rubber-band motor is worthy of any other place than on nursery toys. Well, what do you think?

* * *

WELL, here's where we cut the motor and fish-tail into the port. So long.

J. B. R.

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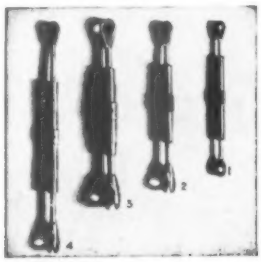

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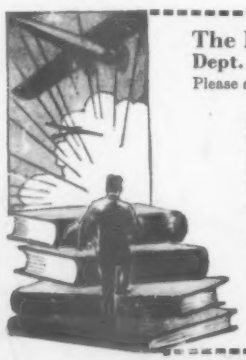

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